The most important thing we build is trust.

Messenger 2 Transmitter Enhanced – SDI Version

M2TE-S

OPERATIONS MANUAL

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Revision History

Revision	Date	Main Changes from Previous version	Edited by	Checked
X1	2 Sept 2011	Initial Release	TGM	
X1A	12 Dec 2011	Add Appendix (A) – IP Static Addressing , Interfacing to a Personal Computer	TG	
X2	18 April 2012	Add operational description of new FW (DSP 2.0 w Xilinx 5) release where applicable.	TG	
X3	28 Sept 2012	Add operational description of new FW (DSP 2.201 w Xilinx 6). New video auto detection, frame reduction, new default groups, new AES-C encryption, update figures with latest GUI pictures.	TG	

1. Important Warning and General Safety Information

1.1 General

The following information is presented to the operator to ensure awareness of potential harmful RF (radio frequency) exposure and general hazards. With regards to potential harmful RF electromagnetic fields the text below is only a brief summary highlighting the possible risks and how to minimize exposure. The summary is based on OET Bulletin 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields".[1] The user should carefully read and comprehend the following before operating the equipment and for additional in depth information refer to OET Bulletin 65.

1. FCC has set guidelines[1] for evaluating exposure to RF emissions that the user must be aware of when operating the M2TE microwave transmitter. The maximum power density allowed from 1.7-7.0GHz is **5mW/cm^2** for occupational/controlled exposure* and **1mW/cm^2** for general population/uncontrolled exposure**. These are the limits for maximum permissible exposure (MPE) as called out in the FCC guidelines (for the above mentioned frequencies).
2. Exposure is based upon the average time spent within the RF field with a given intensity (field units in mW/cm^2)[2]. Hence it may be controlled (or at least minimized) by observing the safe distances and time exposed. Safe distances are calculated from equations predicting RF Fields.[3]
3. The transmitter is a mobile device, is rated at 0.2W (+23dBm) RF power and is capable of harmful radiation if safe operating practices are not observed.

*"*Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means....." (2)*

** "*General population/uncontrolled exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general public would always be considered under this category when exposure is not employment-related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area." (2)*

4. **Antenna minimum safe operating distance is 20cm** (8inches) when using a 2dB Omni antenna. It is the responsibility of the qualified end-user of this intentional radiator to control the save distances and exposure limits to bystanders.

[1] OET Bulletin 65, Appendix A Table 1 Limits for MPE
http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf
[2] OET Bulletin 65, page 9, definitions of types of exposure
[3] OET Bulletin 65, page 19, Equations for predicting RF Fields
http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf

5. **Do not substitute any antenna for the one supplied** or recommended by the manufacturer. The installer is responsible for ensuring that the proper antenna is installed.

6. It should be noted that this device is an intentional radiator, hence:

   Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

   NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

7. DC power (+12VDC nominal) to the unit should never be applied until the antenna (or other suitable load) has been attached to the device SMA RF output connector. Safe operating procedures must be observed when unit is transmitting into an antenna (see sections 1 &2 above).

8. Electro-Static Discharge (ESD) precautions should be observed as a safe practice.

9. The transmitter will generate considerable heat and is the responsibility of the end user to properly heat sink the device before using.

2. Acronyms

This section lists and describes the various acronyms used in this document.

Name	Meaning
16 QAM	16-state Quadrature Amplitude Modulation
64 QAM	64-state Quadrature Amplitude Modulation
A/V	Audio/Video
AES	Advanced Encryption System (32 bit)
ASI	Asynchronous Serial Interface
BDC or BDCC	Block down converter
COFDM	Coded Orthogonal Frequency Division Multiplexing
CVBS/Y	Composite video/Luminance with S-video
D/C	Down-Converter
FEC	Forward Error Correction
GUI	Graphical User Interface
HD	High Definition
I/O	Input/ Output
Kbaud	Kilobaud per second
Kbps	Kilobits per second
Mbps	Megabits per second
MER	Modulation Error Rate
MPEG	Moving Picture Experts Group
MSR	Messenger Smart Receiver
M2D	Messenger Two Decoder
M2TE	Messenger Two Transmitter Enhanced
M2L	Messenger Two Link
NTSC	National Television System Committee
PAL	Phase Alternation Line
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RX	Receiver
S/N	Signal-to-Noise Ratio
SD	Standard Definition
SDI	Serial Digital Interface
TX	Transmitter

3. Introduction

3.1 About the Manual

Cobham User Manuals focus on providing the end user an easy to understand operational instructions to quickly setup and deploy the equipment. The Cobham Technical Operation Manuals focus on the technical details and setup of the equipment. The Technical Manuals also provide a more in depth explanation of the settings and specifications of the equipment that technicians can use to verify the operational status.

3.2 Warranty

Cobham offers a 12 month standard product warranty. During this period, should the customer encounter a fault with the equipment we recommend the following course of action:

- Check the support section of the website for information on that product and any software/firmware upgrades.
- If fault persists call our support line and report the fault. If fault persists and you are informed to return the product, please obtain an RMA number from the Cobham support department or website and ship the equipment with the RMA number displayed and a description of the fault. Please email the support section the airway bill/consignment number for tracking purposes.

Depending on the nature of the fault, Cobham endeavor to repair the equipment and return it to the customer within 14 days of the item arriving at our workshops. Obviously it is impossible to cater for all types of faults and to manage 100% replacement part availability, and delays are sometimes inevitable.

Please contact Cobham for details of packages that can be tailored to meet your individual needs, whether they are service availability, technical training, local geographic support or dedicated spares holdings.

3.3 Safe Operating Procedures

- Ensure that the power supply arrangements are adequate to meet the requirements of this product.
- Operate within the environmental limits specified for the product.
- This product requires external cooling to stay within its operating limits. Be sure to use an adequate heat sink.
- Only authorized, trained personnel should open the product. There are no functions that required the User to gain access to the interior of the product.

Warning: Opening this product will void its warranty!

4. General System Information

4.1 Overview

The Messenger 2 Transmitter Enhanced (M2TE) is a second generation AVC HD/SD COFDM transmitter that combines all the features and capabilities of Cobham Surveillance's (CS's) Messenger 2 AVC HD/SD Transmitter with the additional features listed in the Key System Features section below. All of this is included in a smaller housing (8.6 cu inches). Key features include optional Dual Audio/Video/Data processing with end to end system-level latencies of down to ~44 mS when used with CS Receiver/Decoders.

The Ultra-low system latency greatly enhances real-time operating when the link is used in time critical situations like piloting Unmanned Aerial Vehicles (UAVs) or Unmanned Ground Vehicles (UGVs) or in threat response. Optional Dual video processing enables 3D content collection which provides depth perception and greater control for UGV applications requiring fine spatial operations like explosive device de-arming. The M2TE's 3D capability also enhances Entertainment, Sports, and ENG applications.

The M2TE can optionally provide time-correlated KLV-1 and KLV-2 META data processing[4] that is used in Airborne Surveillance Applications and Geospatial determination. The META data can be extracted from the SDI/HD-SDI video's ancillary data space or input on a separate RS-422 interface.

The M2 Series "Messenger Two Series" product line incorporated AVC / H.264 compression technology with ultra-low delay that covers all the SD and HD formats up to 1080P. AVC compression provides dramatically increased compression efficiency over MPEG-2 which allows our link to provide superior coverage over a wider operating range!

There are two core hardware configurations for M2TE. The HD/SD-SDI configuration accepts up to two Standard Definition (SD) or High Definition (HD) 4:2:2 Digital Video (HD/SD- SDI) or analog composite Video and Analog Stereo Audio Inputs (Mic or Line Level) and/or optional Embedded Audio up to a total of two stereo pairs or four mono channels sets or one stereo pair or two mono channels per program. Mic bias is also provided. In the HDMI configuration[4], the HD/SD-SDI interfaces are replaced with two HDMI interfaces that accept both digital video and audio.

Both Video programs can be compressed according to the Advanced Video Compression (AVC) / H.264 (HD/SD) specification with the same or different frame resolutions, rates and formats. The low-latency AVC Encoder supports the Baseline Profile with extensions with resolutions from 480 to 1080 with support for either interlaced or progressive formats. The Audio is compressed using MPEG-1 Layer 2 compression. Low rate Auxiliary data up to 115 KBaud can be optionally supported. Both programs Audio, Video and Auxiliary Data Packets PES Streams are multiplexed with Basic Service Data to indicate their respective Service Names. If two programs are active, the two transport streams are multiplexed into a single multi-program stream. The stream can be optionally scrambled with AES scrambling system to provide protection in sensitive applications. User selections for all transport stream ID numbers and service names are provided.

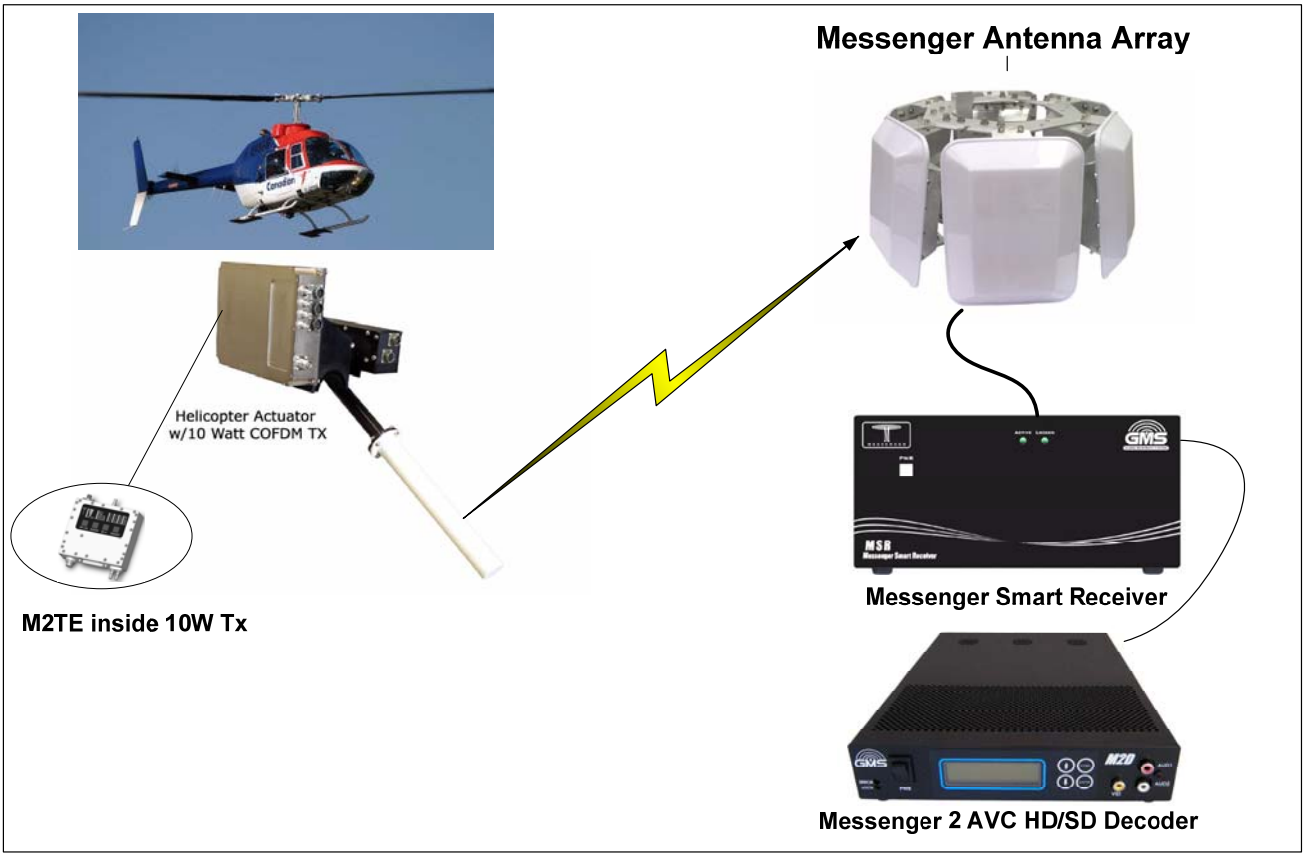
The M2TE is a complete system with Audio/Video encoders/compressors and all the required processing to transmit the modulated signal with up to 200mW of RF over a wide variety of RF bands. External Power Amplifiers are available to boost the signal to up to 15W (band dependent). CS' COFDM wireless

[4] In development, future update

equipment provides standard a robust digital modulation system known as Coded Orthogonal Frequency Division Multiplexed (COFDM) that provides frequency diversity and powerful Forward Error Correction (FEC) algorithms. This modulation is ideas for transmitting over water or into urban environments which typically have high multi-path interference. Product development plans include the ability to switch via a command to single carrier modulations for Line of Sight (LOS) applications and compatibility with other surveillance systems.

Our Messenger Receivers include an option for Spatial Maximal Ratio Pre-Detect Diversity Combining to combat multipath reflections found in indoor/urban environments. CS' Messenger six or eight channel receivers with associated Messenger Antenna Arrays (MAAs) provide wide reception range without the hassle and cost of an auto tracking antenna system. The Messenger series Tx/Rx products provide a robust wireless link that is effective against the multipath interference experienced by analog systems and provides reliable data transmission in the most difficult of terrains.

Messenger 2 Wireless Airborne Camera Link



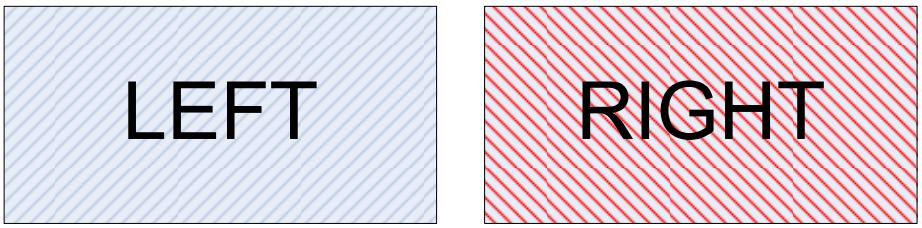
LAN/IP Port

The M2TE contain a 10/100BaseT LAN interface that can be used both for Control & Status monitoring and for Transport Stream (TS) streaming in and out of the device. The IP address can be assigned automatically via a DHCP server or via manual settings. Control & Status monitoring is accomplished via

a WEB server application that launches from the device. TSs can be sent out or in via UDP/IP or RTP/UDP/IP protocols.

3D Support

3D is a very new area in the Broadcast industry. From a content collection standpoint it is normally accomplished with two separate cameras that are GEN-LOCKED together outputting two separate Video signals.



Content Collection Format

The encoder maintains a frame by frame synchronization as it goes through its processing.

AES Scrambling

The AES Scrambling option can be used to add security to your data transmission. The system scrambles the payload portion of the TS packets. Only the TS header remains unscrambled to enable operation with standard DVB-T receivers. The 256/128 bit-scrambling key is entered through the M2TE's control interface. The user can enable or disable the scrambling as well as choosing if the key is stored within the Tx or not via CS' Microsoft Windows control program. Encryption on/off is also available from the local control panel (if it was previously turned ON).

Local Control Panel

The M2TE includes a simple local control panel that allows the selection of up to 20 set-up configurations, Encryption Enable/Disable, switch between Mic and Line Level inputs and selection of 4 output power levels. Status indicators are provided for the presence of input Audio, Video and RF output. Each of these set-up configurations can independently control every programmable parameter in the TX including RF Frequency, Modulation Mode, Compression Modes and Video Resolution to name a few. These Set-Up Groups can be configured by Administrative Personnel using the CS M.S. Window's Control Application prior to fielding the equipment.

This manual provides information on how to operate the M2T-E as well as pertinent technical information related to the overall system. Refer to the model identifier (on-line document, 100-MNI0115 - latest revision) at the Cobham website, http://www.cobham.com/tcs, for available frequency and power configurations along with options.

Key System Features

- Ultra-Low End to End System Latency (down to ~44 mS)[5]
- AVC HD/SD Encoder (Up to 1080p 30FPS)
- Supports Dual Audio/Video/Data programs (Option)
    - Multi-Camera Support
    - 3D Support
- COFDM Modulation (DVB-T 2 K or 4 K Carriers[6])
- Bandwidths DVB-T 6,7,& 8 MHz (STD) & 12, 14 & 16 MHz (4 K[6])
- Output Frequency: 0.9 to 7 GHz (In-Bands)
- Dual L/S Band Capability
- Dual 3Gbps HD/SDI-SDI and Analog SD Video Input Interfaces Option
- Dual HDMI Video Input Interfaces Option[7]
- Analog Audio and Embedded Audio
- Transport Stream Streaming via LAN or ASI or Serial Interface
- Time Correlated KLV Meta Data handling[7]
- Secure – BCRYPT AES 128/256 Encryption or AES-C 128/256
- Control via local panel or remote LAN Web Server or Serial Interface
- Video Input(s) format type automatically detected-no setup required by user

Signal Processing

The Messenger 2 Transmitter Enhanced (M2TE) series accepts up to two Standard Definition (SD) or High Definition (HD) 4:2:2 digital videos or analog SD videos and analog stereo audio inputs (Mic or Line level). Each video is compressed independently according to the Advanced Video Compression (AVC) /h.264 specifications. Therefore, the video inputs can either the same resolution and frame rate or completely different resolutions and frame rates. The low-latency AVC Encoder supports the Baseline Profiles with resolutions from 480 to 1080 with support for either interlaced or progressive formats. The audio is compressed using MPEG layer II compression. Low rate Auxiliary data up to 115 KBaud can be optionally supported.

The basic system supplies support for generation of a single audio/video/data program within a MPEG Transport Steam (TS). The audio, video and auxiliary data packets PES streams are multiplexed with basic service data to indicate the service name. The stream can be scrambled with AES scrambling system to provide protection in sensitive applications.

The dual system option supplies support for generation of two independent audio/video/data programs within a single MPEG Transport Steam (TS). The dual program stream can also be scrambled with AES scrambling system to provide protection in sensitive applications.

The M2TE can operate in one of two modes When the Transmit Mode is enabled the TS will be sent to the COFDM RF transmission processing section. In this mode it can also be streamed out optionally the ASI output port and/or the LAN port for local distribution or recording on external

[5] When used in Ultra-Low Latency mode (Intra-Refresh) with Cobham's Messenger 2 Decoders and Receiver Decoders
[6] With 4K High-Throughput Option on M2TE or Encoder Mode
[7] In development, future update

devices. The second operating mode is the Encoder-Only Mode. In this mode the COFDM RF transmission chain is disabled and only the ASI and LAN ports are active.

There are two COFDM operating modes available; standard 2K DVB-T compliant and a Cobham unique 4K mode[8]. The 4K mode provided twice the data throughput than 2K mode (2x RF bandwidth) and allows the transmission of high quality dual HD video in a robust 16-QAM format.

COFDM 2K Carrier Mode

In 2K Mode the M2TE uses standard DVB-T coding and modulation. DVB-T stands for Digital Video Broadcasting — Terrestrial; it is the DVB European-based consortium standard for the broadcast transmission of digital terrestrial television that was first broadcast in the UK in 1997. This system transmits compressed digital audio, video and other data in an MPEG transport stream, using coded orthogonal frequency-division multiplexing (COFDM or OFDM) modulation.

The OFDM scheme works by splitting the digital data stream into a large number of slower digital streams each of which digitally modulate a set of closely spaced adjacent carrier frequencies. COFDM goes a step further by using a "Coding" scheme to map the data onto the multiple carriers in a way that maximizes recovery from link errors. This coding includes Forward Error Correction with Convolution Interleaves' and Reed Solomon encoding along with careful distribution of the data onto the multiple carriers. COBHAM CS has chosen to use 2K carrier in which 1,705 carriers actually carry the payload that are approximately 4KHz apart. DVB-T offers three different modulation schemes (QPSK, 16QAM, 64QAM).

4K Carrier Mode

The 4K HIGH-THROUGHPUT OPTION enables user-selectable options to set bandwidths from 6 MHz to 16 MHz and to double the throughput of our standard M2T (Up to 63 Mbps!). In 2K carrier mode the system would need to operate in 64-QAM to support dual program/video operations. Using 4K carriers and the 16 MHz bandwidth, the link can support dual program/video HD operation using 16 QAM. This increases link robustness and provides an additional 13.5 dB of gain with a link margin increase greater than 4.7 x in operating range! For the same throughput rate in a standard HD MPEG-2 DVB-T system! With the 4 K HIGH-THROUGHPUT OPTION you can run with fully DVB-T compliant 2K carriers and bandwidths of 6, 7, or 8 MHz. When you switch to 4K carriers you can select 12, 14 or 16 MHz bandwidth.

4.2 Video Quality and 2K or 4K Transmission

The M2TE uses Advanced Coding Standard (AVC) also known as h.264 or MPEG-4 Part 10. It is 30-40% more compression efficient than MPEG-2 which helps achieve high quality HD or SD video through a standard 2K DVB-T wireless link.

Video quality depends on many complex factors including;

- Video resolution and frame rate
- Single or dual video processing

[8] With 4K High-Throughput Option on M2TE or Encoder Mode

- Level of detail and contrast
- Level of motion in the video
- Level of noise in the video
- Existence of repeating patterns in the video

The required level of video quality will not be the same for all applications. Broadcasters often demand high-quality while certain surveillance applications may be satisfied with much less quality. Since we support a wide variety of applications we allow a wide range of settings. Not every set-up configuration will be acceptable for all applications.

Through experimentation it has been found that a single 1080 resolution HD video at 30 fps can be supported with very good video quality under most video conditions at ~16 Mbps. 720p @60 fps needs ~14 Mbps for similar quality. Simple HD video scenes can be supported at very low bit rates, 4Mbps for example. However, they will degrade rapidly with motion or noise. The M2TE's factory defaults for single program/video operation are set to the aforementioned levels which can be accomplished with 2K DVB-T transmission using 16-QAM which is reasonably robust in most wireless environments.

The factory defaults for dual program (dual video) with 2K DVB-T run in 64-QAM operation and allocate ~12 Mbps per program/video. At these rates the video will still be good. However, as the videos become more demanding there will be more artifacts. Also, 64-QAM operation will reduce the operating range and robustness of the link.

If you are using a mixture of HD and SD you can allocate more of the data bandwidth to the HD program using the Video Bit Rate Allocation controls in the set-up configuration group parameter. This parameter allows the user to allocate a percentage of the channel bit rate to program A vs. B.

If you want to get the video quality and range of our single program/video operation with dual HD videos you will need to go to our 4K operation which doubles the throughput of the link. Note that the RF bandwidth is also doubled. However, in this mode you will be able to go back to 16-QAM and have high video quality with reasonable link range and robustness.

5. Hardware Overview

The basic M2TE-S transmitter configuration is outlined in this section:

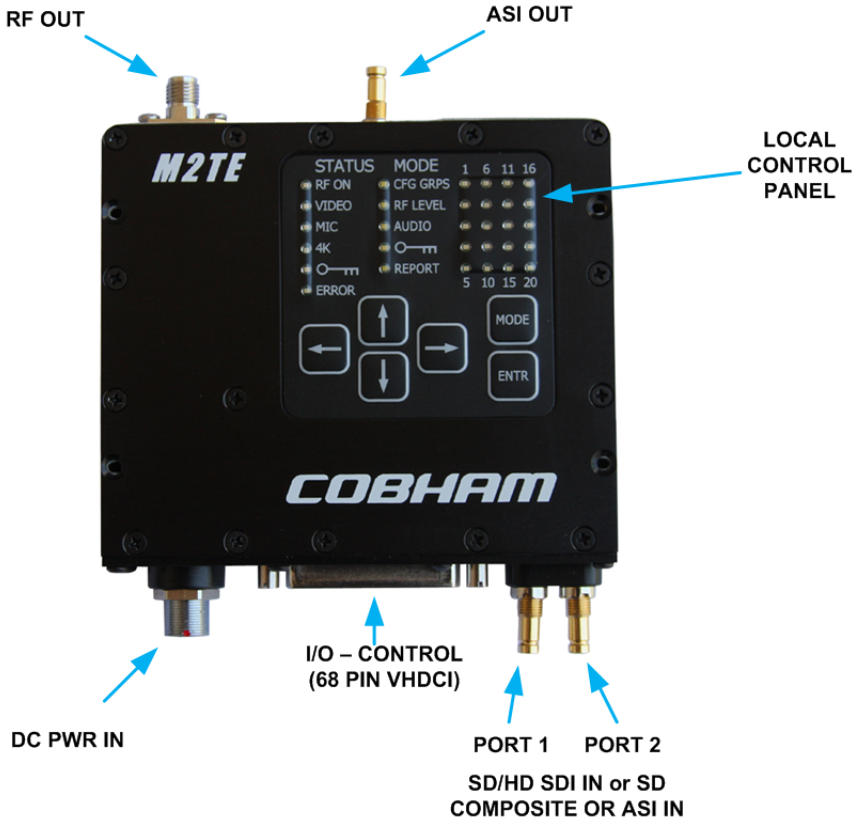


Figure 1 – M2TE-S Connectors

5.1 M2TE-S Connectors

There are six connectors located on the M2TE-S unit as shown in Figure 1. They are for interfacing the RF out, HD//SD-SDI Video or ASI in or SD Composite in (Two ports), ASI out, audio, Auxiliary Data, KLV Data, LAN/IP and Control signals. The Local Control panel is also shown in Figure 1.

5.1.1 RF Output, Ant Port

The M2TE uses a female SMA connector for its 'RF Output' port. The antenna is normally attached here. This port can also drive additional external amplifiers for high-power applications like Aerial downlinks.

Note: Transmitters should not be powered on without a load attached to the RF output. Doing so could damage the internal Power Amplifier (PA).

5.1.2 ASI Out

A 75 Ohm female 1.0/2.3 3Gbps connector is provided for DVB-ASI Transport Stream Output. The output bit rate is 270 Mbps.

Table 1 – Recommended 1.0/2.3 3G mating connector

Manufacturer	Part Number
Cambridge	XGT-8000-NGAF

5.1.3 HD/SD-SDI IN/ASI IN/COMPOSITE

Both video input ports use a 75 Ohm female 1.0/2.3 3Gbps connector for SD-SDI or HD-SDI or SD composite video input streams. The input bit rate is 270 Mbps for SD and 1.485 Gbps to 2.97 Gbps for HD. The Composite SD inputs can support either NTSC or PAL video formats.

In addition these input connectors can be used as an input for ASI DVB compliant Transport Streams. See section 7, software overview, for details on the Input Modes. This section explains how to switch from SDI IN to ASI IN using the Cobham M2TE Web Configurator.

Table 2 – Recommended 1.0/2.3 3G mating connector

Manufacturer	Part Number
Cambridge	XGT-8000-NGAF

5.1.4 DC IN

The M2TE accepts +9-+32V DC on a 4 position LEMO connector. Pins 1 & 2 connect to +VDC and Pins 3 & 4 connect to GND.

Table 3 – Recommended DC IN mating connector

Manufacturer	Part Number
LEMO	FGG.0B.304.NLAS2
ODU	S10LON-P04MFG0-5200

5.1.5 I/O – CONTROL

The 'I/O - CONTROL' connector is a male, high-density VHDCI-68. It is used to provide the interface for audio, Mic Bias, Auxiliary data, KLV data, RS-232, LAN/IP control & streaming, I/O interface.

Normally, the M2TE is controlled via the LAN/IP interface via an internally launched WEB interface. However, it also has two separate RS232 channels/interfaces that can be used one at a time for control and monitoring the unit. These same interfaces can be used to send asynchronous low-Rate DATA along with the audio and video.

Table 4 – Recommended VHDCI mating connector with Cable

Manufacturer	Part Number
MOLEX	79918-0080

Table 5 – I/O - Control VHDCI-68 Connector Pin Out

Pin	Signal	Notes
1	GND	Digital GND
35	GND	Digital GND
2	RS232 Data RX1	RS232 Port 1
36	RS232 Data TX1	RS232 Port 1
3	RS232 Data RX2	RS232 Port 2
37	RS232 Data TX2	RS232 Port 2
4	GND	Digital GND
38	GND	Digital GND
5	AUDIO 1 DIFF P	Positive AUDIO input 1
39	AUDIO 1 DIFF N	Negative AUDIO input 1
6	AUDIO 1 BIAS	Microphone 1 Bias Voltage (+1.5 volts)
40	AUDIO 2 BIAS	Microphone 2 Bias Voltage (+1.5 volts)
7		Factory only use – leave this pin open
41		Factory only use – leave this pin open
8	AUDIO GND	GND for Audio Signals
42	AUDIO GND	GND for Audio Signals
9		Factory only use – leave this pin open
43		Factory only use – leave this pin open
10	AUDIO 3 BIAS	Microphone 3 Bias Voltage (+1.5 volts)
44	AUDIO 4 BIAS	Microphone 4 Bias Voltage (+1.5 volts)
11	AUDIO 2 DIFF P	Positive AUDIO input 2
45	AUDIO 2 DIFF N	Negative AUDIO input 2
12	AUDIO GND	GND for Audio Signals
46	AUDIO GND	GND for Audio Signals
13	GND	Digital GND
47	GND	Digital GND
14	IO BRD ID0	Reserved for special applications
48	IO BRD ID1	Reserved for special applications
15	DSP GPIO1	Reserved for special applications
49	DSP GPIO0	Reserved for special applications
16	DSP GPIO2	Reserved for special applications
50	DSP GPIO3	Reserved for special applications
17	GND	Digital GND
51	GND	Digital GND
18	RS422-A P	Port A – For KLV Meta data and other serial data
52	RS422-A N	Port A – For KLV Meta data and other serial data
19	RS422-B P	Port B – For KLV Meta data and other serial data
53	RS422-B N	Port B – For KLV Meta data and other serial data
20	RS422-C P	Port C – For KLV Meta data and other serial data

Pin	Signal	Notes
54	RS422-C N	Port C – For KLV Meta data and other serial data
21	GND	Digital GND
55	GND	Digital GND
22	3.3v I/O	Reserved
56	3.3v I/O	Reserved
23	3.3v I/O	Reserved
57	3.3v I/O	Reserved
24	FPGA GPIO3	Video1 and video 2 reference clock test point. Selectable
58	FPGA GPIO2	GPS one Pulse Per Second (1PPS), 3.3v standard input.
25	FPGA GPIO1	Reserved for special applications
59	FPGA GPIO0	Reserved for special applications
26	USB D P	Part of USB interface
60	USB D N	Part of USB interface
27	USB VBUS	Part of USB interface
61	PA EN	External PA Control (+3V TTL ON)
28	SPARE 0	Reserved for special applications
62	SPARE 1	Reserved for special applications
29	GND	Digital GND
63	+3.3V	
30	ENET LTC LED	Part of LAN I/P interface
64	ENET LTA LED	Part of LAN I/P interface
31	ENET RTC LED	Part of LAN I/P interface
65	ENET RTA LED	Part of LAN I/P interface
32	CHASSIS GND	Safety Ground connected to housing
66	CHASSIS GND	Safety Ground connected to housing
33	ENET RD P	Part of LAN I/P interface
67	ENET RD N	Part of LAN I/P interface
34	ENET TD P	Part of LAN I/P interface
68	ENET TD N	Part of LAN I/P interface

5.2 Analog Audio Input Configurations

The M2TE has two analog audio circuits. Each circuit is dedicated to one “Program” and has separate configurations/settings for Line and Mic levels. Remember that each of the two video inputs are processed and distributed as separate Programs in the M2TE’s Transport Stream. These ports support a single differential (MONO) input or dual (STEREO) Line-Level inputs. Only one set of inputs will be active at a time per Program.

Table 6 below defines the wiring for all the different possibilities along with the location of Mic Bias connections.

Table 6 - Audio Configurations

Audio Configuration	Program #1 Audio (reference table 5 above)	Program #2 Audio (reference table 5 above)
Balanced high input impedance (100K)	Pin 5 (+ input) Pin 39 (- input) Pin 42 (AUDIO GND)	Pin 11 (+ input) Pin 39 (- input) Pin 46 (AUDIO GND)
Single ended high input impedance (100K)	Line 1: Pin 5, AUD GND Pin 8 Line 2: Pin 39, AUD GND Pin 42	Line 3: Pin 11, AUD GND Pin 12 Line 4: Pin 39, AUD GND Pin 46
Mic Bias (1.5 VDC)	#1 Pin 6 #2 Pin 40	#3 Pin 10 #4 Pin 44
Note: If 600 Ohm input impedance is required add a parallel 600 Ohm resistor to the external cable assembly.		

6. Local Control Panel Operation

☞ Note: The active settings are maintained in a separate non-volatile memory area; separate from the 20 Configuration Groups we call Group 0. This was done to enable the M2TE's ability to power-up in the same configuration that was in-play prior to the shut-down of the unit, when the Group 0 settings have NOT been saved into 1 of the 20 Configuration Groups. Changes can be made either from the Front-Panel or from the LAN GUI (via a LOAD command) that will only affect Group 0.

☞*WARNING: Before attempting to make any group changes (or switching to a different group) to the transmitter from the front Local Control Panel ensure the unit has correct video input(s) per the current configuration attached, the unit is fully initialized and there are no video errors indicated by the Status Error LED indicator on the front panel.*

In addition any changes implemented from the front panel once the ENTR key has been pushed are saved into the current active group (see discussion on Groups in section 7).

6.1 Local Control Panel Introduction

The M2TE can be controlled locally by a user interface panel integral to the transmitter. This interface shows some status and control settings of the transmitter and allows some limited changes to its operation. M2TE has preset configuration groups where you can program various common settings from a computer then simply change the groups as desired.

There are three operational modes; **Status**, **Configuration** and **Locked** modes. *Default Operating Mode* (*Status Mode*) is the main mode that the local control panel is in when not being actively used. The *Configuration Mode* is when the user is using the control panel to view current settings (and values) or is using it to change various settings. The administrator has the ability to control access to the various modes of the local control panel, so they cannot be changed by the end user. In *Locked* mode, the user has access to additional information than in the *Default Operating Mode* but is not allowed to modify this information.

This section of the manual describes the control panel's operating modes, how to read and change its settings.

6.2 Local Control Panel Physical layout

The control panel has 4 main sections:

- **5** "**MODES**" LEDs,
- **6** "**STATUS**" LEDs,

- **20 Numbered** LEDs,
- **6 key pads (MODE**, **ENTR**, **4 ARROW KEYS)** for the user interface.

See Figure 2 - M2TE control panel. Each of the main sections is further explained below.

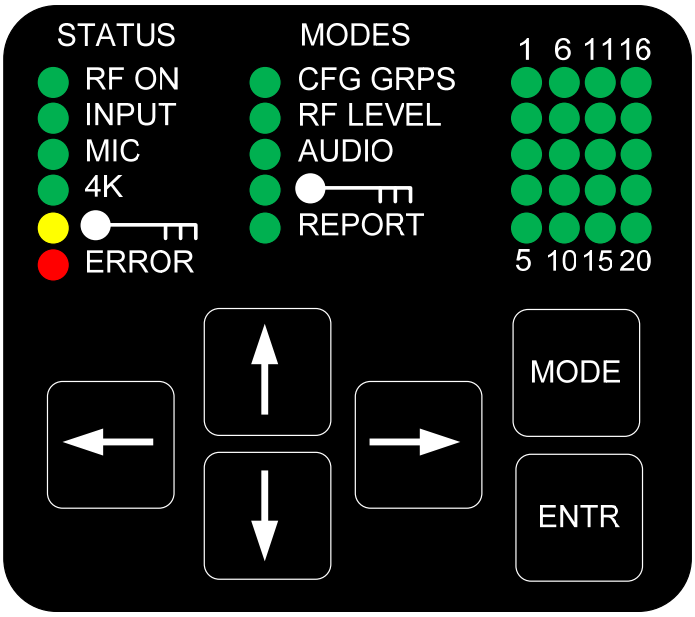


Figure 2 - M2TE control panel

6.3 Power-up Sequence

When the M2TE is first powered on, the local control panel LED is displayed in the following manner. It will give you an indication that all systems are up and operating normally. Each new set of lights indicate a different system check is completed. Full power up initialization should only take approximately 15 seconds.

1) Step 1 – The red ERROR LED starts blinking immediately when power is first applied to the M2TE. It keeps on blinking during the first part of the initialization process and then follows the column LEDs ON and OFF initialization (see step 2 below) until full initialization of the unit. It turns OFF if all systems are good to go (and doesn't find any faults). If it remains ON after full power up (after step 3 below) then this is an indication to the user of a fault condition. The *Status* page in the LAN GUI is the easiest ways to find out what the fault condition may be. Reference section 7.6

2) Step 2 -- A column at a time lights up then turns OFF. Starting with all "*STATUS*" LEDs, all "*MODE*" LEDs, *Numbered* LEDs 1-5, 6-10, 11-15 and finally 16-20. Lastly all columns of LEDS light at the same time and then go out.

3) The *CFG GRPS* LED turns on and the M2TE's current configuration group LED lights up. Any other *STATUS* LED turns on as it would in normal operation mode.

6.4 Numbered LEDs

The Numbered LED section, pictured in Figure 3 - Numbered LEDs, is used to display various information associated for each MODE LED. Figure 4 - Alphanumeric Characters Displayed on Numbered LED's shows Alphanumerical and characters that are displayed. The default setting for the numbered LEDs is the active configuration group. All Numbered LEDs are green.

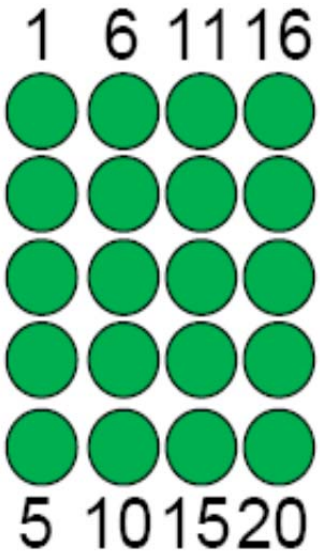


Figure 3 - Numbered LEDs

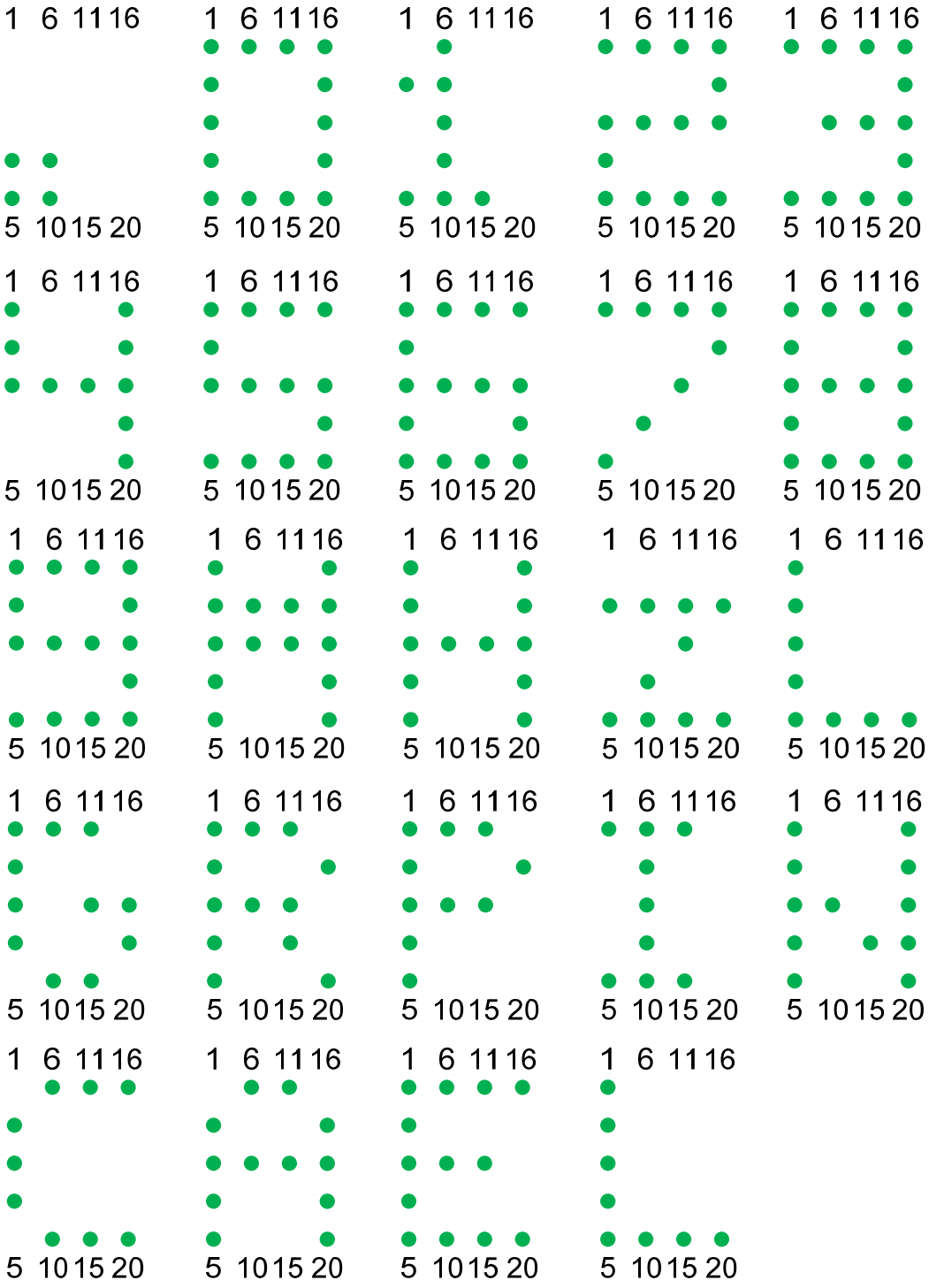


Figure 4 - Alphanumeric Characters Displayed on Numbered LED's

6.5 Key Pads

The 6 push button key pads, “MODE”, up”↑”, down“↓”, left”←”, right “→” and Enter “**ENTR**“, help the operator change the settings and view the status of the M2TE transmission.

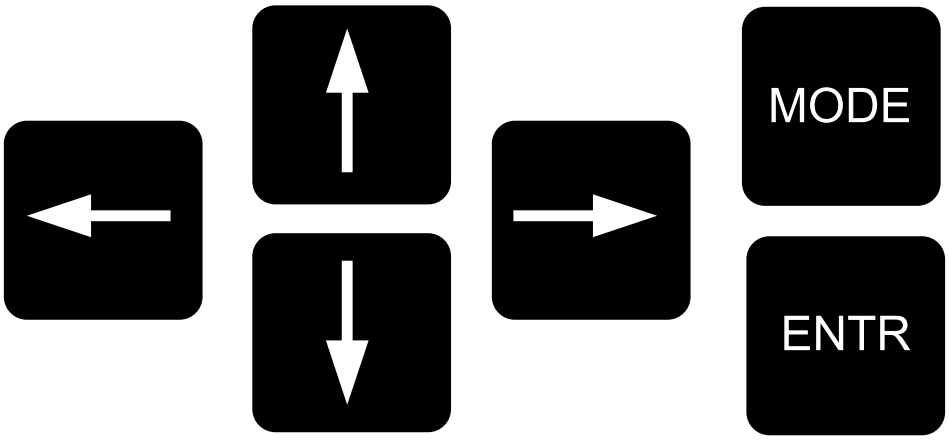


Figure 5 - Key Pads

6.5.1 “MODE” Key Pad

Each push of the MODE key cycles from the current mode sequentially to the next mode and in doing so displays in the Numbered LEDs section the current settings/values for the current mode. Pressing the *MODE* key after the ***REPORT*** LED is selected puts the control panel into *Default Operating Mode (*Status Mode).

6.5.2 Arrow Key Pads “↑↓←→”

The arrow key pads are used to move around in the Numbered LEDs section to be able to select new settings/values for each of the MODEs when that particular MODE has been selected, indicated by the blinking MODE LED.

NOTE: Go to Modes section for a better description of their uses.

6.5.3 Enter Key Pad “ENTR“

Pressing the ENTR key pad implements and saves any settings/value changes. If the ENTR key is not pressed then changes do not take place and the M2TE continues to operate without any disruptions.

6.6 Modes

When the *MODE* key is pushed one of the *MODES* LED lights and starts to blink indicating which "*MODES*" is active, see Figure 6 - MODES LEDs. This means the Numbered LEDs (1-20) to the right now only represent the current value/setting of the active MODE. While the MODE is active (MODE LED is blinking) the user can change the values/settings assuming it is a read/write MODE. Some MODES such as the *REPORT* are read only MODES. As stated previously new settings/values *are not* change until the **ENTR** key is pressed. Also some MODES may be skipped over as the MODE key is pressed because it is not currently available. This could be because in the LAN GUI the feature was turned OFF. For more information on how to set each MODE, see that MODES description below. The local control panel times out if there is no keypad activity for several seconds. Unless otherwise programmed, the mode ***CFG GRPs*** LED turns solid, indicating the front panel is in *Default Operating Mode*; the Numbered LEDs display the current configuration group.

Figure 6 - MODES LEDs

6.6.1 Configuration Groups (CFG GRPS LED) Operation

6.6.1.1 Checking the RF Frequency of the Current Configuration Group

1) Press the *MODE* key until the "***CFG GRPS***" LED is blinking. The current configuration group selection is displayed in the Numbered LEDs section.
2) Press no other keys for 1 second; the current configuration group's RF frequency (XXXX.XXMHz) scrolls across the Number LEDS one character at a time.
3) Press the Enter "**ENTR**" key to put the control panel into *Default Operating Mode*.

☞*NOTE: New settings/values are never changed until the **ENTR** key is pressed. If the current setting is re-selected, if the panel times out, or if the Mode key is pressed then the M2TE keeps the previous setting/value without any disturbance to the M2TE operation.*

6.6.1.2 Changing Configuration Groups

1) Press the *MODE* key until the ***CFG GRPS*** LED is blinking. The current configuration group selection is displayed in the Numbered LED section.
2) Use the up, down, left, and right keys, "↑ ↓⟷" to highlight a new value (a new configuration group 1-20). If no key is pushed for 1 second, the current highlighted selection will have its RF frequency scroll across the Numbered LEDS in the following manner, XXXX.XXMHz.
3) To view another configuration group's RF frequency press the arrow keys at any time, highlight the desired configuration group LED then wait 1 second for the frequency to display.
4) Press the ***ENTR*** key to make the current highlighted preset configuration groups active. This sets the M2TE to the new value and puts the control panel into *Default Operating Mode*.

6.6.2 RF LEVEL (Green LED)

1) Press the *MODE* key until the ***RF LEVEL*** LED is blinking. The current RF power setting (1 to 4) is displayed in the Numbered LED section.
2) Use the up and right keys, "↑→", to increase the value. Use the down and left keys, "↓←", to decrease the value. A zero (0) value indicates RF is OFF. RF values and the corresponding numerical indicators (1, 2, 3 or 4) are set using the LAN GUI.
3) Press the ***ENTR*** key to enable the current power level selection.

6.6.3 Analog AUDIO (Green LED)

☞ *NOTE: If the **Audio** MODE LED is skipped then analog audio has either been disabled or it's been configured for embedded audio. If audio is needed then change the configuration group to one that has analog audio enabled. Embedded audio cannot be addressed from the front control panel, only through the LAN GUI WEB interface.*

1) Press the *MODE* key until the ***AUDIO*** LED is blinking. Two LEDs in the Numbered LEDS section light for a brief time, either *1&2* or *3&4* indicating the current active audio channel; the volume level value associated with the active audio channel is displayed next in the Numbered LEDs section.
2) Use the up and down keys, "↑ ↓", to increase/decrease the audio volume. Zero (0) value indicates volume is at lowest power and nine (9) is at maximum.
3) Press the **ENTR** key to accept the new value.

Note: If only one audio channel is active and the other is OFF then only the volume adjustment for the active channel can be made. If both audio channels are active then continue with step 4 below to switch to the other audio channel.

4) Use the left and right keys, "→ ←", to change between the different active audio channels which are displayed in the Numbered LEDs section (1&2, or 3&4), depending upon the group configuration).
5) Use the up and down keys, "↑ ↓", to increase/decrease the audio volume. Zero (0) value indicates volume is at lowest power and nine (9) is at maximum.
6) Press the **ENTR** key to accept the new value.

☞*NOTE: Settings will not change until the **ENTR** key is pressed. If the current setting is re-selected, if the panel times out, or if the mode key is pressed then the M2TE will keep to the old setting without any disturbance to the M2TE operation.*

6.6.4 ENCRYPTION (THE "KEY" Green LED)

☞ *NOTE: There are a few guidelines associated with encryption which the user needs to be aware of to have a better understanding of how the encryption MODE "* *"LED works:*

A. Encryption is a purchased option. If it hasn't been purchased then in the LAN GUI under the "***Encrypt***" tab in the Configuration Groups/ Setup menu the encryption mode & key buttons are grayed out. If this is the case then the encryption MODE " " key LED is skipped over when pressing the "MODE" button.

B. Encryption must be set to either "*AES/128*" or "*AES/256"(this is a generic term, AES encryption modes will vary depending on which AES options have been purchased; the modes are listed under the "Encrypt" tab in the Configuration Groups/Setup menu)* using the **LAN GUI** interface. Once the AES ENCRYPTION MODE has been activated from the LAN GUI the *STATUS* encryption "" key (yellow LED) on the front panel lights. The encryption keys (up to 5 keys) should also be pre-set using the LAN GUI.

C. If the encryption *MODE* key "" LED lights the user is then able to change to a pre-defined key, up to 5 different keys using the control panel arrow keys (↑ ↓→ ←) . In addition the user is also able to turn the current AES mode to OFF by selecting the zero (0) value using the control panel arrow keys (↑ ↓→ ←). Or if the current mode is *OFF* the user can turn it back *ON* by selecting one of the 5 pre-defined keys. Keep in mind the functions described here in step C depend on step B above to be true.

With an understanding A, B & C above the following is the basic operation of the Encryption MODE using the front control panel:

1) Press the *MODE* key until the KEY "" LED is blinking. The value which appears in the Numbered LEDs section indicates the current encryption key or if a zero (0) value the current encryption mode is OFF (in which case the *STATUS* LED "" is also OFF).
2) Use the arrow keys, "→ ←↑ ↓" to select a different encryption key (1 through 5). The *STATUS* LED next to the key" " turns ON if a value other than zero (0) is selected. If zero (0) value is selected then the *STATUS* LED turns OFF.

3) Press the **ENTR** key to make the current selection active. This sets the M2TE to the new settings and puts the control panel into *Default Operating Mode*.

☞*NOTE: Settings will not change until the **ENTR** key is pressed. If the current setting is re-selected, if the panel times out, or if the MODE key is pressed then the M2TE keeps the previous settings without any disturbance to the M2TE operation.*

6.6.5 REPORT (Green LED)

☞*NOTE: The **REPORT** MODE is a read only dual function mode, it displays the errors indicated by the red "ERROR" led and can also display the current active IP address.*

1) Press the *MODE* key until the ***REPORT*** LED is blinking.
2) If any errors are present (the red STATUS ERROR LED should be ON also) the numerical values are displayed in the Numbered LEDs section. Reference Table 7 below for the interpretation of the values. There can be several values displayed at one time. For example if video 1 and video 2 inputs are disconnected from the M2TE the number 1 & 2 LED would light up (in the Numbered LEDs section) when the REPORT LED MODE is active (blinking). And if you read in table 7 below the error for #1 is "Video 1 Input missing or invalid" and error for #2 is "Video 2 Input missing or invalid".

LED #	ERROR
1	Video 1 Input missing or invalid
2	Video 2 Input missing or invalid
3	Video 1 format does not match configuration
4	Video 2 format does not match configuration
5	Audio Stream 1 missing or invalid
6	Audio Stream 2 missing or invalid
7	Future Use

LED #	ERROR
8	Future Use
9	Future Use
10	Future Use
11	Future Use
12	Future Use
13	Future Use
14	Future Use
15	Future Use
16	Invalid RF Board Type or missing RF card
17	RF Board Database is corrupted or has not been programmed
18	Main Database is corrupted or has not been programmed
19	Hardware Error
20	System Error

Table 7 - Report Error Table

6.6.5.1 REPORT IP Address

The following procedure can be used to read the current IP address off of the local control panel.

- Press the *MODE* key until the *REPORT* LED is blinking.
- Press the *ENTR* key.

The IP address is presented one character at a time in the Numbered LED section. Keep in mind if DHCP addressing mode is used the M2TE IP (Ethernet) cable must be plugged into a network before the IP address is displayed otherwise it will show all zeros, 0.0.0.0.

*Note: The default factory setting is a static IP address of **192.168.1.36**. If the IP addressing of the M2TE transmitter is changed to DHCP ensure the network in which it gets attached to supports DHCP addressing. See Appendix A -for additional details on IP addressing and interfacing a personal PC to the M2TE. Also refer to section **7.4** (how to find current IP address using the serial port of PC) and section 7.7.4(changing the network addressing).*

The M2TE transmitter supports Auto-MDIX (Medial Dependent Interface Crossover). In general it means a crossover IP cable is not needed when it is plugged into a network or a personal PC.

6.7 Status LEDs

The status LEDs are an active display of various functions. They continually inform the user of the function, or lack of function, of the M2TE. This section explains the meaning of the *STATUS* LEDs.

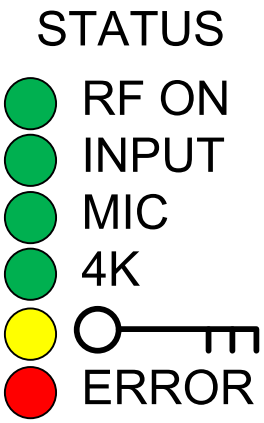


Figure 7 - "STATUS" LEDs

6.7.1 RF ON

The green ***RF ON*** LED indicates whether the M2TE is sending a transmitted signal through the RF port or not. If the LED is ON the transmitter is transmitting wireless data. If it is OFF the RF transmitter is OFF.

6.7.2 INPUT

The green ***INPUT*** LED indicates that the M2TE detects either a video stream on one or more of its inputs or an ASI stream if that is what it is set-up to process. If the LED is ON the M2TE has active input video stream(s) on one or more video port(s) and/or Ethernet port, whether the M2TE is actively processing it or not, see the "ERROR" LED for more info. If it is OFF the M2TE does not detect any input video streams. If blinking it indicates the transmitter is expecting two video inputs but it is only receiving one video. Check either the STATUS page using the LAN GUI or use the *REPORT* button for the active error code and use Table 7 above for the actual error.

6.7.3 MIC

The green ***MIC*** LED indicates whether the audio input is set to MIC level. IF the LED is ON the M2TE is set to receive a MIC level audio and analog audio is enabled. If it is *OFF* the audio input mode has been set to Line level, embedded audio or to *OFF* mode. If a dual video/audio program is active the "MIC" LED will light if only one of the audio inputs has been selected for Mic level. In this case you would have to reference the LAN GUI for the exact audio settings.

6.7.4 4k Operation

The green ***4K*** LED indicates whether the M2TE is setup in 2K or 4K transmission stream. If the LED is ON the M2TE is in 4K mode and transmits data in two different 2K C-OFDM streams. If the LED is OFF then M2TE transmits data in one 2K C-OFDM or other stream. Note that 4K operation (mode) is a purchased option.

6.7.5 ENCRYPTION (THE "KEY")

The yellow ***KEY*** LED when ON indicates that the data being transmitted is encrypted. If the LED is OFF then the encoder module transport stream is not encrypted.

6.7.6 ERROR

The red ***ERROR*** LED when ON indicates a fault condition, there can be more than one. A common cause could be that video is disconnected or the unit is expecting two video streams but is only receiving one.

Rapid Flashing of the Error LED at startup indicates that there has been a fatal Boot Error. Slow steady Blinking at startup indicates that the system is doing self-tests and initializing. Patterned blinking at startup indicates a fatal error with the Xilinx FPGA. Patterned blinking after the system has been running indicates that the system has shut down because it has over heated. To reset the system, the system should be shut down (remove power) and allowed to cool. When the device is cool, it may be repowered.

For more information, go to the "REPORT" mode, note the error code and then reference Table 7 - Report Error Table for the actual errors. If the LED is *OFF* then the M2TE is working as indicated by the local control panel.

6.8 Locking the local control panel interface

To help prevent accidental changes, the local control panel can be locked. Use the LAN GUI and from the *Select System Setup/Control Panel* menu click on the "Lock" button and then the "Apply" button. In the "Lock" mode the control panel only displays the current status of the different "MODES" LEDs. No changes can be made from the local control panel if "Lock". Any changes would then have to be made using the LAN GUI.

6.8.1 Setup lock

As stated in above in section 6.8 the user has the ability to lock the M2TE local control panel so that the operator cannot change any settings while in operation. If the local control panel is locked out, the only way to unlock it is by using the LAN GUI from the *System Setup/Control Panel* menu.

6.8.2 Locked Modes

This section describes how the "MODE" key works when the local control panel is locked.

"CFG GRPS"

1) When the local control panel is in *Default Operating Mode* and you press the "MODE" key, the *CFG GRPS* LED starts blinking. CFG GRPs cannot be changed from the front panel when in locked mode.
2) Press the *MODE* key to go to the next MODES' LED.
3) Press the *ENTR* key to place the local control panel back in *Default Operating Mode*.

"RF LEVEL"

1) Press the *MODE* key until the "RF LEVEL" LED lights. The Numbered LEDs show the current RF power level (Levels 1-4 or 0). Note that the value zero (0) means that the TX's RF Control is *OFF*.
2) Press the *MODE* key to go to the next MODES' LED.
3) Press the *ENTR* key to place the local control panel back in *Default Operating Mode*.

"AUDIO"

1) Press the *MODE* key until the *AUDIO* LED lights (only if analog audio is enabled). The Numbered LEDs 1&2 or 3&4 light up indicating the current audio channel and then displays the current audio volume level for that channel. If two audios are enabled then press the right or left arrow key, the next audio channel LEDs light up (1&2 or 3&4) and then the corresponding audio level is displayed.
2) Press the *MODE* key to go to the next *MODES*' LED.
3) Press the *ENTR* key to place the local control panel back in *Default Operating Mode*.

ENCRYPTION (THE "KEY" 🔑)

1) Press the *MODE* key until the encryption KEY LED lights (only if encryption is enabled or was previously enabled, see section 6.6.4). The Numbered LEDs show the current encryption key or the value zero (0) if it's *OFF*.
2) Press the *MODE* key to go to the next MODES' LED.
3) Press the *ENTR* key to place the local control panel back in *Default Operating Mode*.

"REPORT"

The *REPORT* mode works the same as in unlock mode. Please refer to 6.6.5 for more information.

7. Software Overview

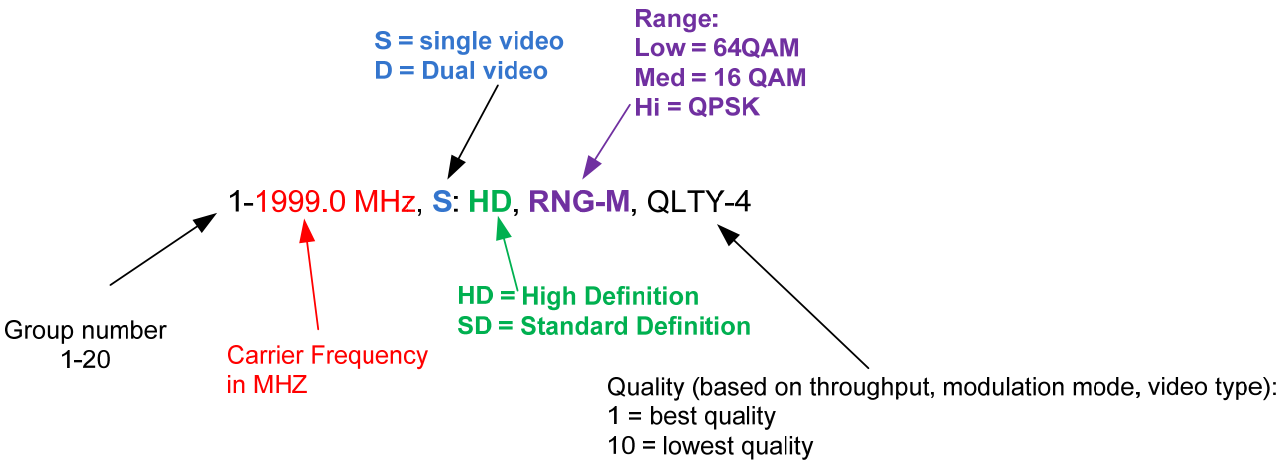
7.1 Product Control & Status Monitoring Approach

Cobham transmitters provide programmable presets or set-up groups that can be configured through a WEB-based control and status interface that launches through the LAN interface from the transmitter. Set-up "Groups" are selected by the user through either the transmitter's local control panel or remotely through the WEB-based interface. The M2TE allows 20 set-up groups.

☞ *Note: There is a behind the scene what we call group 0 (zero) active at all times. This group allows any changes made to the transmitter using the LAN GUI which have not been saved to the current active group (1-20) to be remembered on the next power cycle (next boot up). Hence it is a sort of protection of the current transmitter configuration in case the user forgets to* ***Save*** *the current configuration settings to the current active group. The best way to operate the transmitter is to save the parameters which have been changed to a group and load that group with the* ***Load*** *command to bring back the parameters associated with that group.*

Administrators define the set-up groups for specific applications. Each set-up group completely defines most of the transmitter's set-up parameters including ***Center Frequency***, output ***RF Power Level***, ***Modulation Parameters***, ***Video***, ***Audio***, ***TS parameters***, ***Encryption***, ***Aux Data*** and ***Streaming***. The M2TE is set up with factory *default* configuration groups. Appendix B - shows three possible group loads depending on the options purchased; for example a "*Dual Program Versions (2K only)*", a "*Single Program Versions*" and a "*Dual Program Versions (4K only)*". Hence if a customer has purchased a single video M2TE then the default group is a "*Single Program Versions*", if a dual video program without 4K has been purchased then the default group is a "*Dual Program Versions (2K only)*" and finally if a dual video program with 4K has been purchased then the default group is a "*Dual Program Versions (4K only*)".

The values shown in the default groups should be considered recommended starting suggestions to help the user get up and running quickly; they can be changed and saved as needed to suit various situations. The nomenclature for the *default* pre-set groups is as follows keeping in mind that the user can change the titles and develop their own jargon for the groups.



Each set-up group can be completely different from any other group. Field personnel can select specific set-up groups via pre-determined guidance from the administrators. Matching the transmitter operation to the receiver operation is as simple as selecting the same set-up groups. For example: If the transmitter is set to preset #19, then the receiver needs to be set to preset #19 for them to operate together. Keep in mind the factory default set-up groups (20 total) are just a starting point. Users are encouraged to configure each group as needed for their custom application(s).

It should also be noted that Cobham transmitters are designed to remember the last set of applied settings and will always power-up in the set-up group settings that it had prior to shut down.

The Web Control and Status interface can be launched from several WEB Explorer interfaces such as Microsoft's Internet Explorer or Fox Fire. The Web interface has been developed to provide in-depth control, configuration and monitoring of the transmitter. When used as part of a higher level system, the M2TE can also be controlled via an RS-232C interface.

This Web-based Graphical User Interface (GUI) program provides the end user with a straightforward way to interface with the M2TE. During normal operation the M2TE Configurator GUI does not need to be active and all external interfaces can be disconnected from the transmitter unit.

7.2 M2TE Web Interface

M2TE web interface supports both low-level basic system setup and high-level functional configurations. It contains pages for support in four categories: (1) General information such as main introduction, real-time system monitoring, product information, and online support link; (2) Configuration groups such as individual group configuration, multi-group configuration file import and export, and restoration of default groups; (3) System setup such as RF power attenuation configuration, encryption configuration, control panel configuration, network configuration, serial port configuration, and logon information update; (4) Upgrade such as DSP and FPGA firmware upgrades, and optional feature upgrade.

The web interface is accessible through Internet web browsers and requires the web browsers to support JavaScript and turn JavaScript capability on. The web interface has been tested with *Windows Internet Explorer 8*, *Firefox 8.0*, and *Google Chrome 16.0.912.63 m*. In the following sections, the initial web interface connection and the available configurations are described in detail.

7.3 Account Management

M2TE supports two account access levels such as ***User*** and ***Administrator***, among which Administrator level is allowed to access all the information that User level can.

The default login information for User level is:

Name: ***user***

Password: ***user***

The default login information for Administrator level is:

Name: ***admin***

Password: ***admin***

The login information can be updated through *Update Logon* web page under *System Setup* menu, which is discussed later.

7.4 Internet Connection

The IP address of the M2TE device must be known before using an internet browser such as Microsoft IE or Mozilla FireFox. The M2TE is shipped with a default Static IP address of *192.168.1.36*. It is beyond the scope of this manual to explain IP addressing details. The user should use caution before changing addressing parameters.

Refer to Appendix A -for additional information on IP addressing and interfacing a personal PC to the M2TE

Note: The M2TE transmitter supports Auto-MDIX (Medial Dependent Interface Crossover). In general it means a crossover IP (Ethernet) cable is not needed when it is plugged into a network or a personal PC.

IP address can be obtained in two ways:

- Front panel (please refer to **6.6.5.1**).
- Serial console interface command ***ngc*** (described next).

To use serial console interface command use a terminal program such as Tera Term Pro or HyperTerminal. Connect a serial port cable from the computer to either Serial 1 or Serial 2 cables (both are terminated with DB9 connectors), portion of the M2TE I/O breakout cable. The M2TE serial port communication requires the following configuration (shown in Figure 8):

Bits per second: **115200**

Data bits: **8**

Parity: **None**

Stop bits: **1**

Flow control: **None**

ASCII Sending/Receiving format: **Line Ends with Line Feeds**

The login information:

Name: *user*

Password: *user*

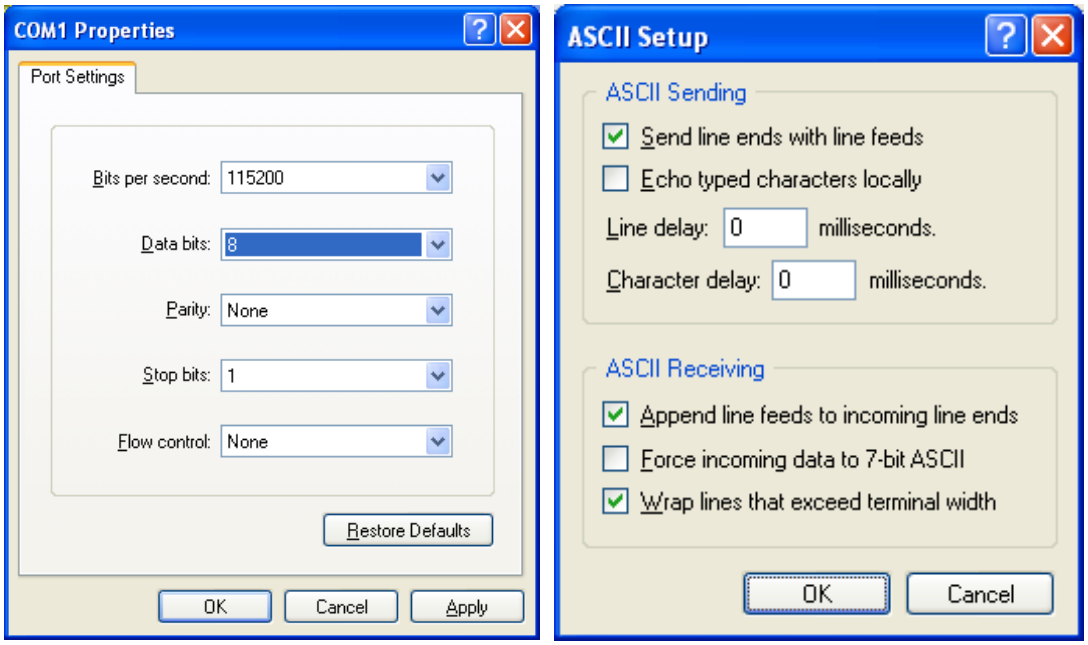


Figure 8 – M2TE serial port connection configuration

After login is accepted, the IP address can be retrieved by typing the command "***ngc***". After typing the "***ngc***" command (and pressing the ENTER key) the current network configuration is displayed.

1> ngc
Network Configuration
Mode: *Static IP Address*
Local Host Name M2TE
DNS IP Address 192.168.1.1

Static Configuration
IP Address: 192.168.1.36
Subnet mask: 255.255.255.0
Gateway IP Address: 192.168.1.1
Domain Name: gmsinc.com

The user should also be aware that from the serial port interface as demonstrated above, the IP address can also be *set* to a different address or changed to a different mode (Static or DHCP). That is with the command "***nsc***", the IP address mode can be changed to DHCP mode if it currently se to static mode. For example the parameters associated with the "***nsc***" command are:

nsc IPAddress:{DHCP:0}

Using this command to change to a static IP address you type the command, a space and then the static IP address ; the standard notation a.b.c.d, four decimal numbers <0-254> separated by three periods <.>, for example "***nsc 192.168.1.36***" (and then press the ENTER key from the keyboard. To change to DHCP mode you would type "***nsc 0***" or "***nsc DHCP***". Keep in mind this only changes the IP address not the entire network configuration.

*Note: After changing IP address mode or the static address you need to **re-power** the transmitter before the changes take place.*

When the IP address of the device is known, the user can proceed to type the IP address in the address bar of an Internet web browser. A web interface welcome page will then be displayed as shown in Figure 9.

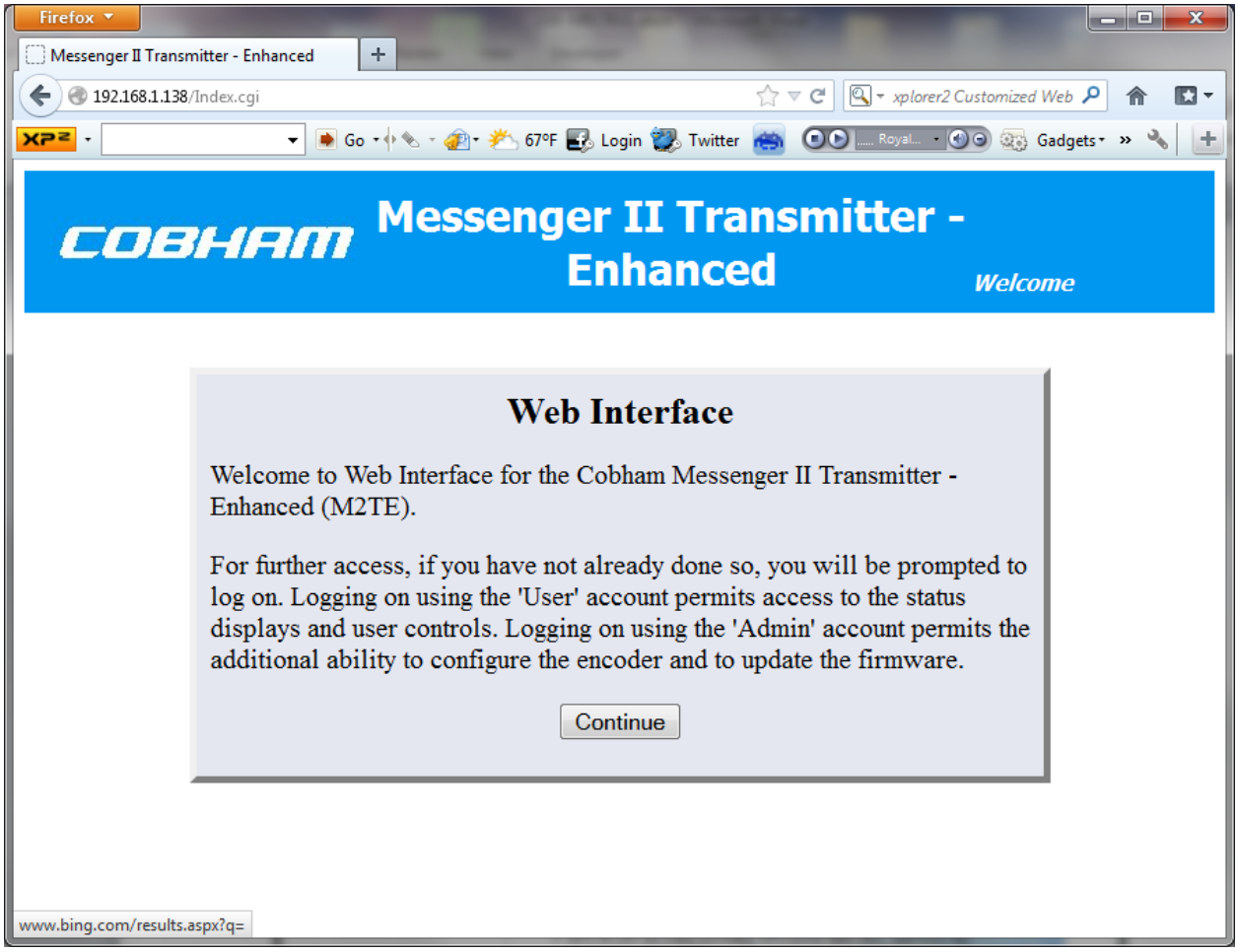


Figure 9 – Web interface welcome page

Click on *Continue* button to reach a login prompt window as shown in Figure 10. Type-in the suitable login information into the *user name* and *password* text boxes. A main page then opens up as shown in Figure 11.

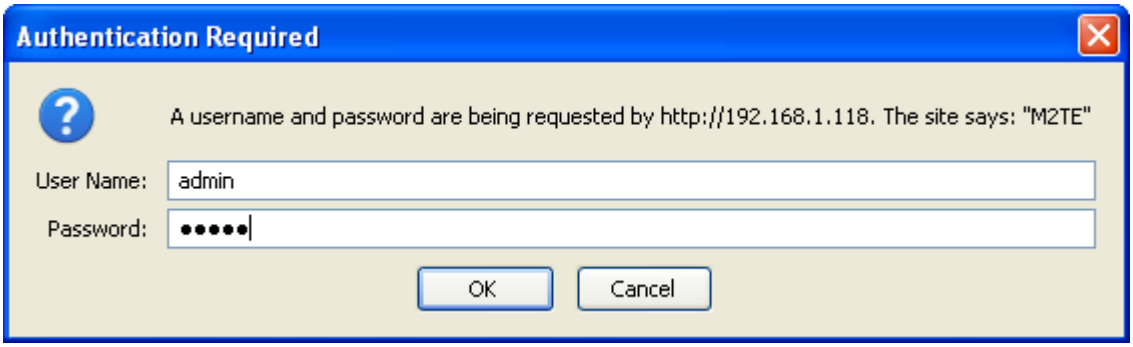


Figure 10 – Login window

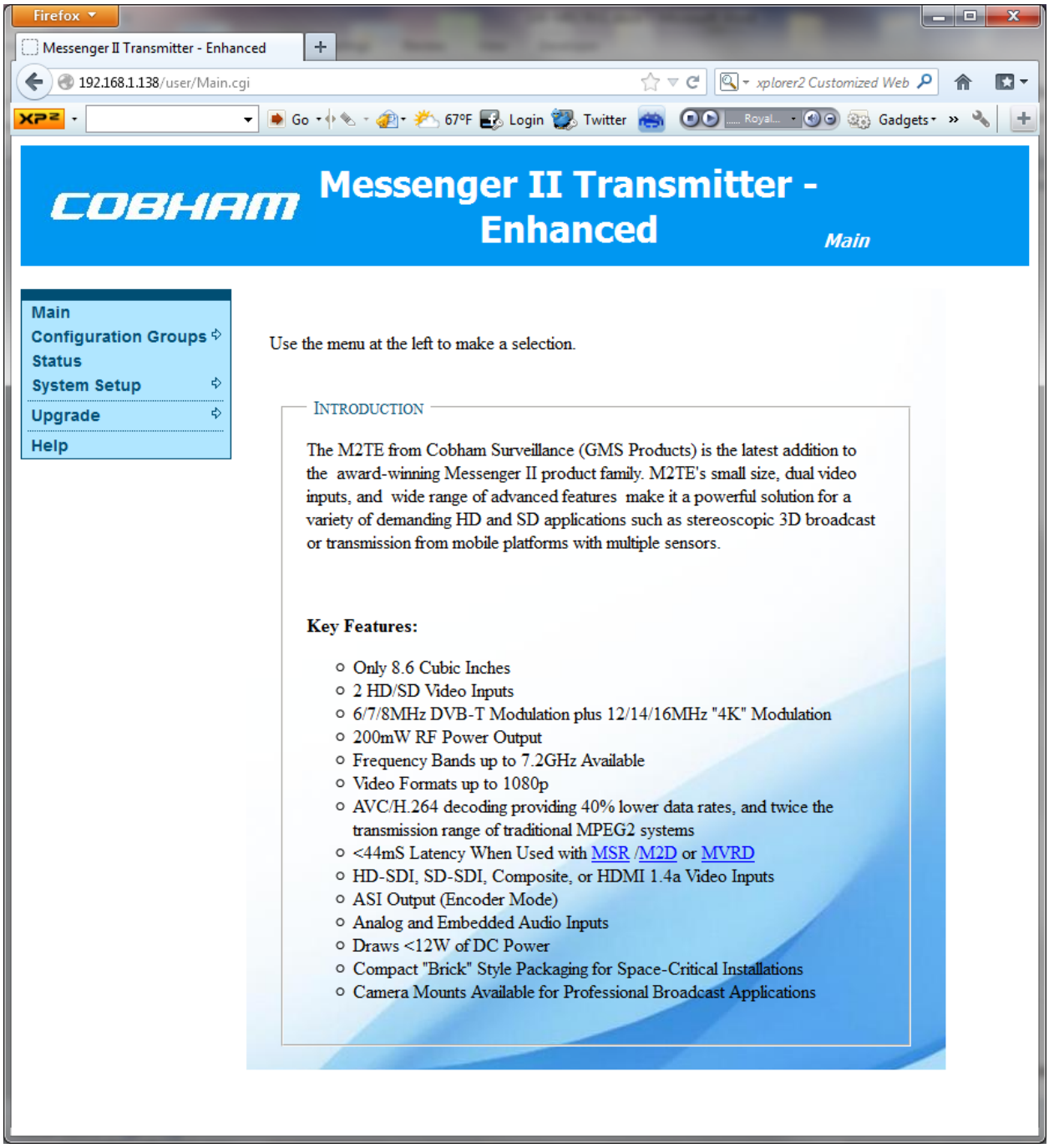


Figure 11 – Web interface main page

Six items are listed in the main menu: *Main*, *Configuration Groups*, *Status*, *System Setup*, *Upgrade* and *Help*. Among the above pages, *Main*, *Configuration Groups* (except for the *Import* and *Restore Default Groups* options in *Configuration Groups*), *Status*, *Update Logon* submenu under *System Setup*, and *Help* are accessible with User level, and the rest of the pages are accessible only with Administrator level. These web pages will be discussed in detail in the following sections.

7.5 Group Configurations

The M2TE supports **twenty** configuration groups where the fundamental system features and functions can be configured and stored into the unit. The *Configuration Groups* selection in the menu provides a tool to display and configure the groups, which contains four options: *Setup*, *Import*, *Export* and *Restore Default Groups*. These options support individual group configuration, multi-group configuration file import and export, and default groups restoration, respectively.

7.5.1 Individual Configuration Group Setup

Click on *Setup* from the *Configuration Groups* item on the menu, the individual group configuration page is displayed, as shown in Figure 12.

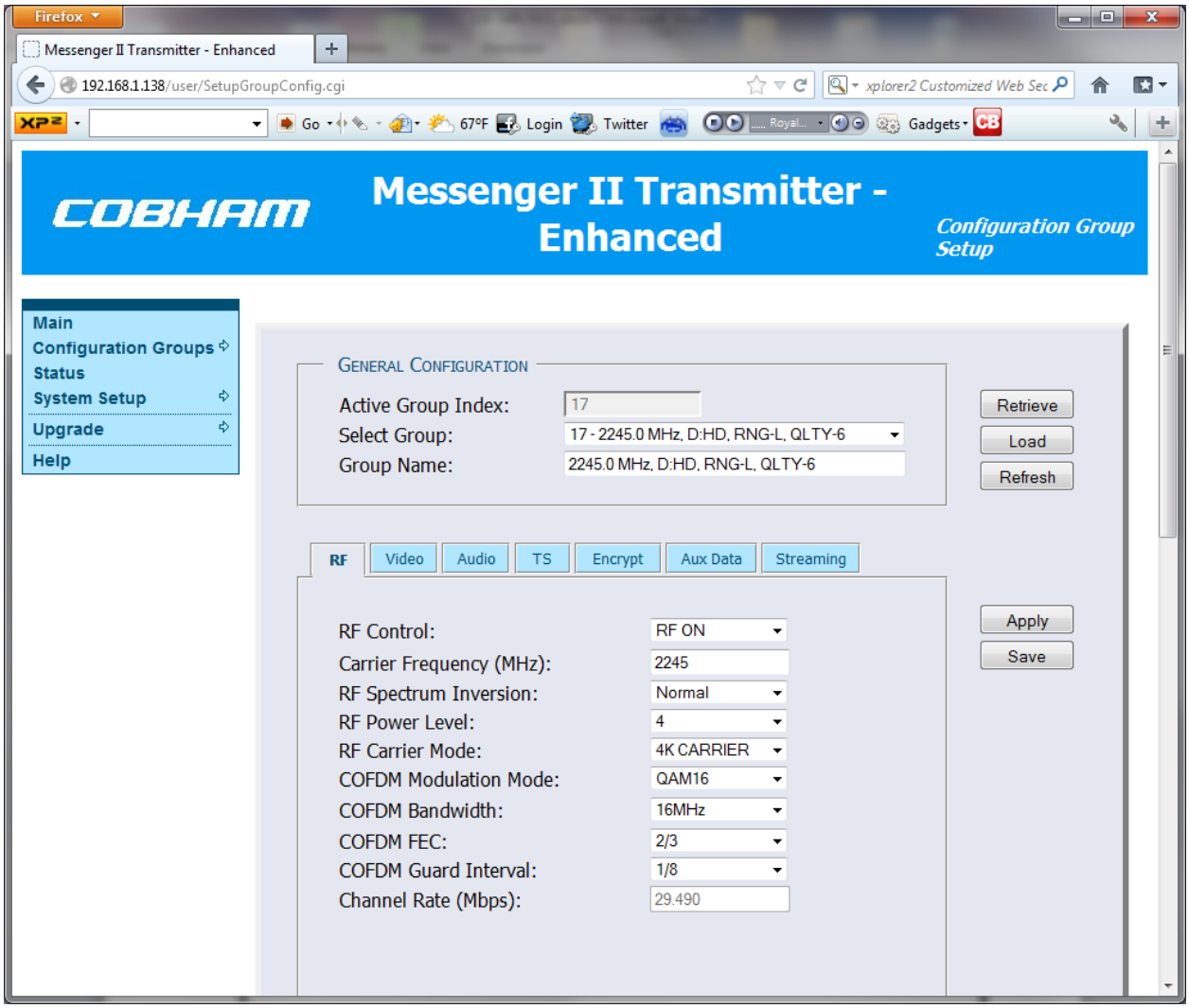


Figure 12 – Individual group configuration page (RF Tab)

The individual group configuration page consists of three sections: general configuration section, the operation buttons, and the tab section.

*Note: the **User** access level on this page can **only** carry out the following operations:*

Select a group
Retrieve a group
Load a group
Refresh the active group information
Apply the edited group
Control RF function ON/OFF
Control analog audio volume(s) and audio pair volume lock(s) if available
Select encryption mode and key index

Section 1:

The general configuration section provides the *Active Group Index*, the selected *Group*, and the *Group Name* for the selected *Group Index*. The *Active Group Index* text box is grayed out because it is not changeable by the user, but rather the status information to reflect the current active group index. When the current group settings are modified and applied to the unit **without** saving into the system database, the *Active Group Index* box will show the index with a *(Modified)* label. The *Group Name* input box can take up to 31 characters.

Section 2:

On the right side of the general configuration and tab sections, five buttons provide the operations that the user can carry out in the M2TE:

Retrieve button – retrieves configuration parameters for the selected group index from the system database **without activating** them.

Load button – loads the configuration parameters from the system database according to the selected group index and activate them in the system **regardless** of the edited parameters in the tab section.

Refresh button – retrieves the **active** group parameters, which could have been modified in the tab section and applied into the system, or could be the original activated group configurations.

☞ ***NOTE**: If unsure of the current active parameters make sure to click on this button. If for some reason a parameter is changed but the "Apply" button (discussed below) is not activated (clicked on) or the changed parameter was saved with the "Save" button but not applied, the user may be mistaken as to which parameter is currently active. Or if the M2TE unexpectedly loses power on the next power up after full initialization the user should click on the "Refresh" button to make sure of the current active parameters.*

Apply button – activates the edited parameters in the tab section **without saving** them into the system database.

Save button – saves the edited parameters in the tab section into the system database according to the selected group index **without activating** them.

It should be noted that the first three of the five buttons are carried out based on only the selected group index ignoring the edited tab section contents, while the last two of the five buttons take the edited tab section contents into effect.

Note that because the **Save** operation stores the edited configuration parameters into the system **without** activating them, therefore, after the ***Save*** button is clicked, the web interface displays the contents of the currently **active** parameters, which could be different than what user has just saved. Reloading or retrieving the group will show you the previously saved information.

Section 3:

The tab section consists of seven tabs: *RF*, *Video*, *Audio*, *TS, Encryption, Auxiliary Data,* and *Streaming* configurations. Due to the internal configuration arrangement, the suitable configuration order is from the left tab to the right tab subsequently.

Note that the optional features which are purchased separately and not part of the defaults are also explained below. Therefore, to be able to configure and use *Video*, *4K RF Carrier Mode*, *128-Bit and 256 Encryption* options the user needs to contact the factory for purchase. Otherwise, the corresponding functions and web GUI displays are grayed out.

***RF* tab** (Figure 12) contains all the available configuration parameters for the radio frequency communication functions. RF function can be completely turned off by selecting *RF OFF* in the *RF Control* drop-down list box. *Carrier Frequency* input frequency values are limited to the purchased band (for example an S2 band is limited to the values from 1990 to 2500 MHz). *RF Power Level* drop-down box offers four RF power levels whose actual power values are predefined initially at the factory and reconfigurable by the user on the *RF Power* page under *System Setup* menu.

Video* tab** (Figure 13) Video is auto detected. The M2TE automatically senses the video format on its input(s). The user does not have to configure video formats, it doesn't matter if the source video is composite (PAL or NTSC), HD-SDI or SD-SDI the M2TE auto detects the video format (reference the specification section 9 for supported formats). However if using a dual stream (a purchased option) the second video (Video 2) must be enabled (as shown in Figure 13). This can be done manually, just go the video tab and enable Video 2 by selecting "On_Auto***" from the pull down box. Or it can be included in a pre-set configuration group in which case just load the configuration group which has been set up for two videos.

Up to two video streams are supported and **at least** one video stream must be present. In other words if one of the video input modes is selected to be *OFF*, the other video input mode cannot be turned off.

The user can check the ***Status*** page to ensure the source video format and the actual detected format match. The Video 1 and Video 2 formats are listed under the "***Audio-Video Formats***" table on the Status page.

The *Video 1 Bitrate Allocation* input box defines the video 1 bitrate percentage of the whole available bitrates for both video streams. If *Video 1* is turned off, *Video 1 Bitrate Allocation* is default to *0* and *Video 2 Bitrate Allocation* is default to *100*. The similar rule applies to the case when *Video 2* is turned off. If both videos are present, the bitrate allocation should take the video formats into consideration due to the different bitrate requirements that various video formats demand.

Under the Video tab the user also has the option to explore various frame rate reductions for Video 1 and Video 2 inputs. Under special circumstances it may be suitable to make use of frame reduction.

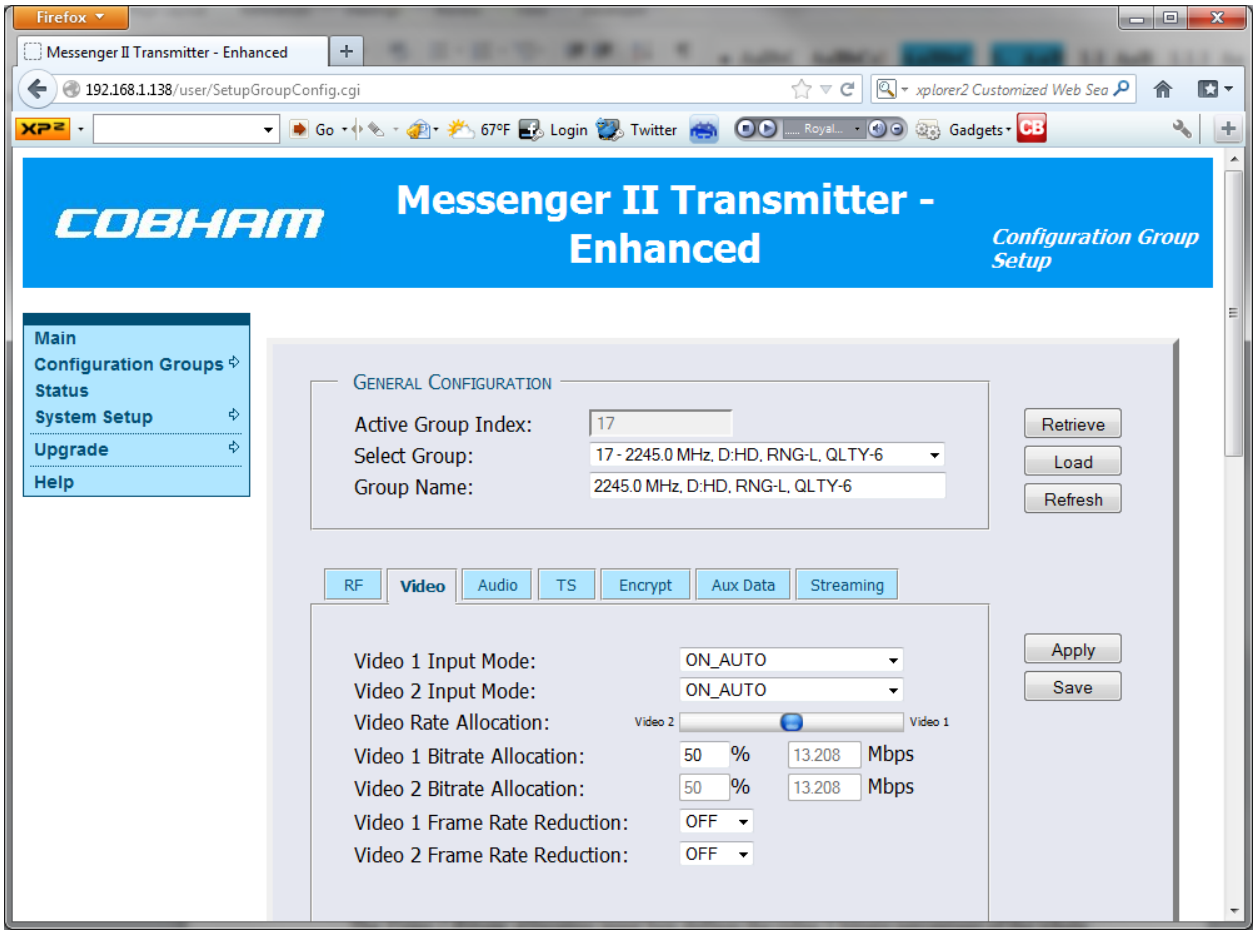


Figure 13 - Individual group configuration page (Video Tab)

***Audio* tab** (Figure 14) provides four sub-sections to support audio configuration. The *analog audio 1-2* or *analog audio 3-4* selection is only available when any *Audio* **Input Mode** is set to *ANALOG*

and its **Analog** drop-down choice is set to the corresponding analog audio. The **Input Mode** selection of either *Embedded* or *Internal Tone Generator* does not allow volume adjustment.

The **Audio 1-2 Sample Rate (or Audio 3-4 Sample Rate***)* drop-down boxes are grayed out and fixed at 48 KHz. The **Audio** 1 (**2**, **3 or 4**) **Mic PreAmp** selection is only available for any corresponding *MIC* choice configured in the *Analog* drop-down box.

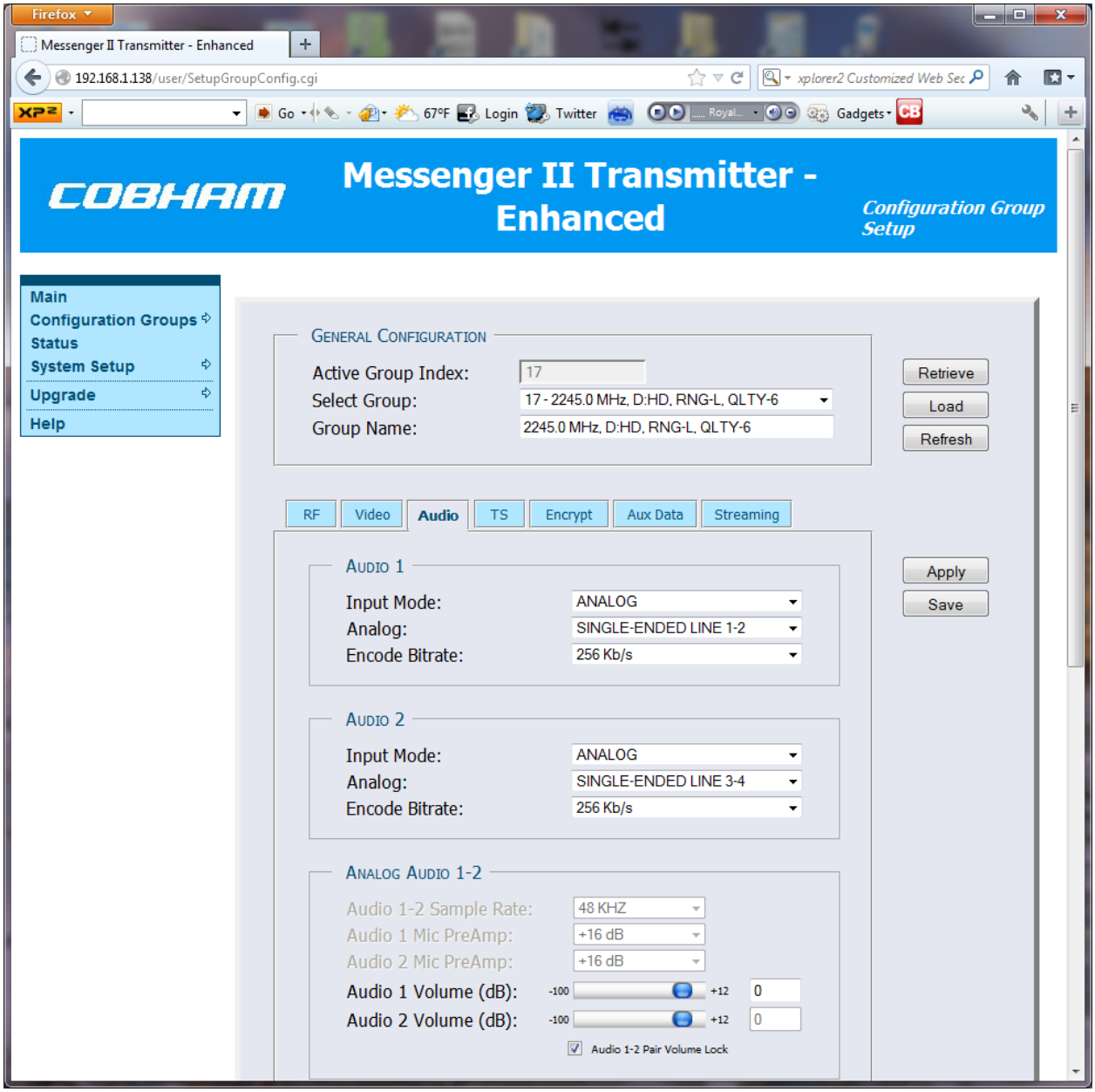


Figure 14 - Individual group configuration page (Audio Tab)

When any *Balanced* analog audio format is selected, the corresponding second *Mic PreAmp* and second *Audio Volume* is automatically synchronized with the first *Mic PreAmp* and first *Audio Volume* respectively, and is not adjustable.

***TS* tab** (Figure 15) allows the user to configure the Transport Stream. Only the variables under the *RF tab* and the *Streaming* tab are available when the *Transport Stream Source* selection of Stream IN, ASI 1, or ASI2 is chosen.

As a general rule when setting the *IDs*, *Program Numbers*, and *PIDs* do not duplicate numbers in the same Transport Stream.

Encoder Only Mode:

The M2TE has the ability to transmit a TS (transport stream) at a rate from 1 to 50 Mbps out of the ASI OUT connector effectively becoming an encoder only module. The RF must be turned *OFF*; the *Channel Rate (Mbps) text box* on this Tab is then activated and the user now has the ability to adjust the TS rate as stated above from 1 to 50 Mbps.

Note: A little current consumption can be saved by disabling the *ASI Out Control* if ASI out is not being used. From the pull down box choose "*Disabled*" and click on the "*Apply*" button.

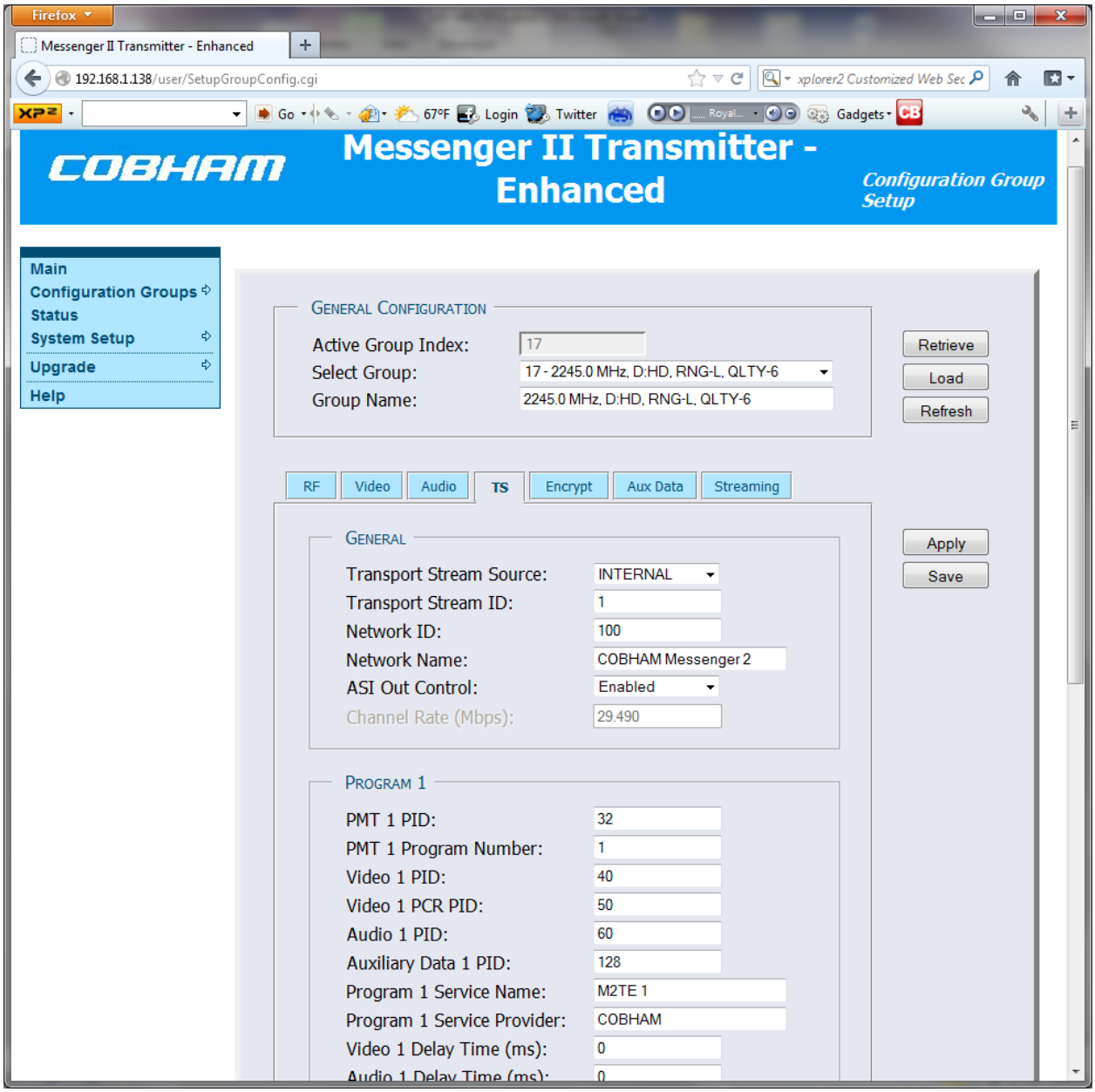


Figure 15 - Individual group configuration page (TS Tab)

***Encryption* tab** Figure 16) allows the user to configure the encryption mode (AES/Bcrypt128/256 or AES-C 128/256) and to select a key (up to 5 keys) . The encryption key storage type and the key value can be configured on the *Encryption* page under *System Setup* menu.

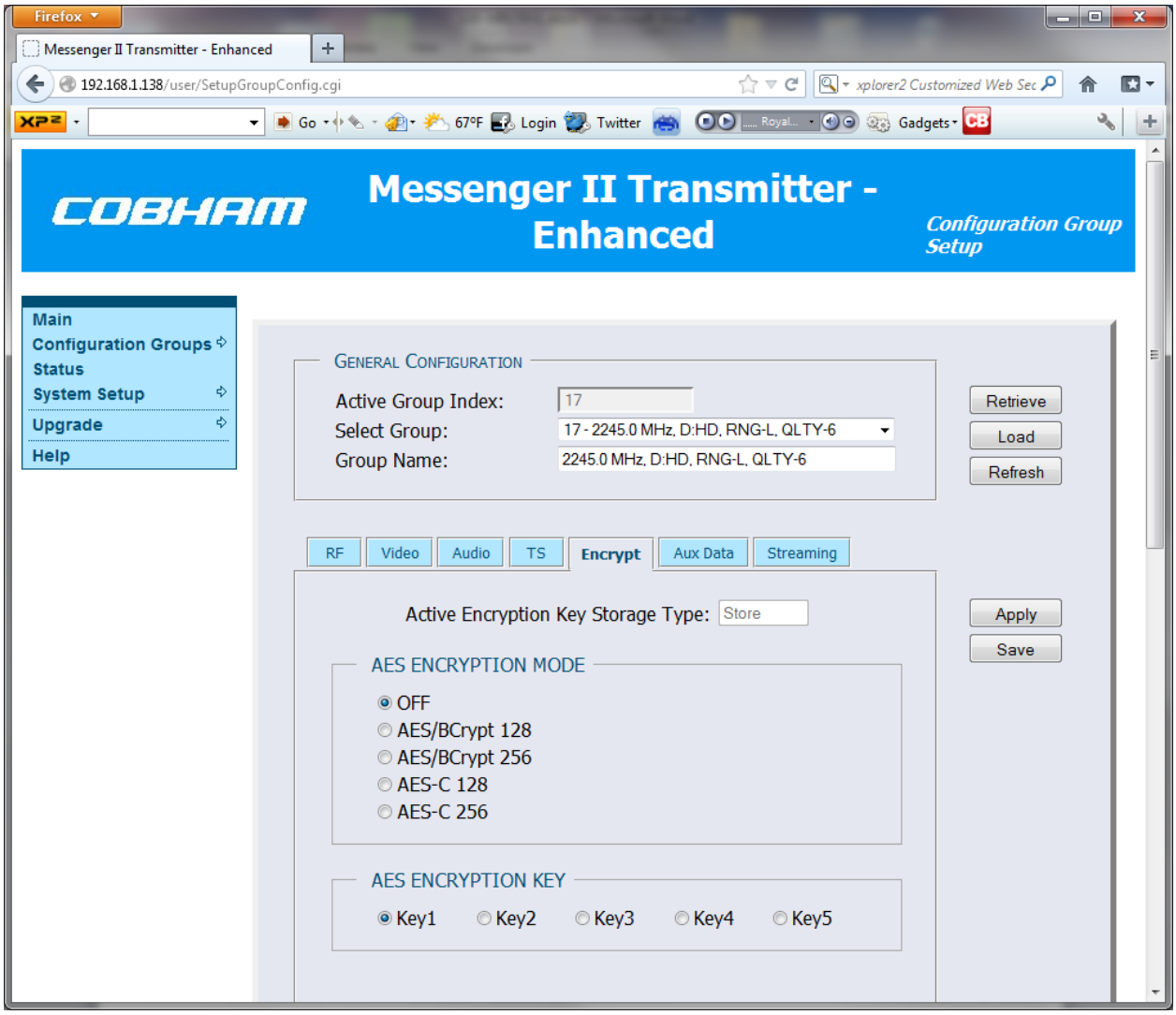


Figure 16 - Individual group configuration page (Encryption Tab)

***Auxiliary Data* tab** (Figure 17) allows the user to turn auxiliary data ON/OFF, to choose 7/8bit data, odd/even/no parity, the baud rate and allows user to change the PID. Note that with a two stream/program there can be an Auxiliary Data associated with each stream/program.

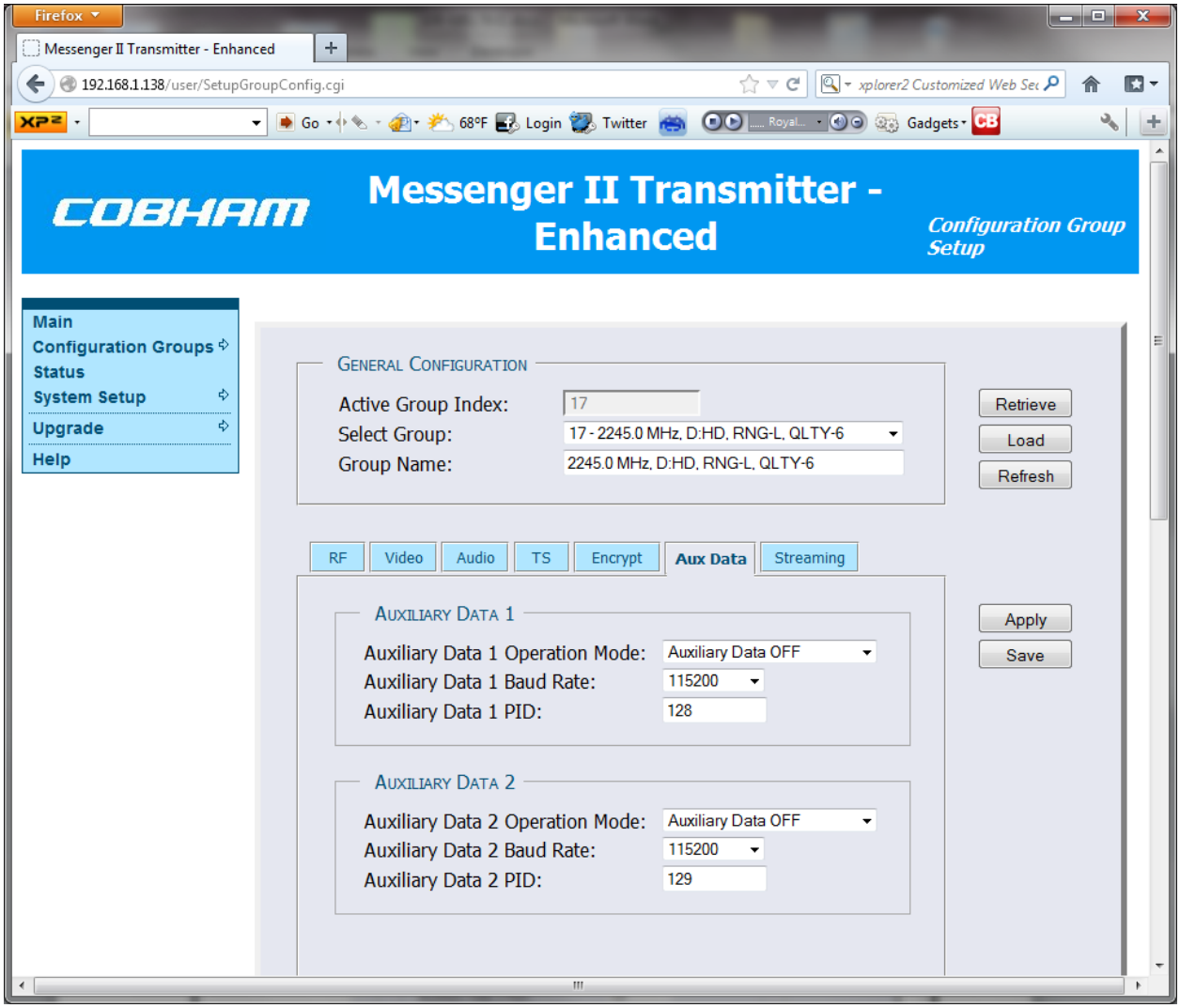


Figure 17 - Individual group configuration page (Auxiliary Data Tab)

***Streaming* tab** (see Figure 18 & Figure 19) contains the LAN streaming configuration for both *Streaming In* and *Streaming Out*. *Streaming In* and *Streaming Out* **cannot** be activated simultaneously. The selection of *Streaming In* on this tab will overwrite the *Transport Stream Source* on *TS* tab, and vice versa.

Streaming Out setup parameters (reference Figure 19)

- *Destination IP Address*: Enter destination IP address here... only works with IPv4 addresses, for example 192.168.1.33.
- *Destination Port Number*: Enter destination port number here, 49152-65535 private port numbers are recommended

- *Destination Protocol:* Choose between *UDP/IP* (user datagram protocol) or *RTP/UDP/IP* (real time transport protocol with UDP) are the only two supported protocols. Ensure destination application supports these protocols.

Streaming IN setup parameters (reference Figure 18)

- Multicast address is not currently working. Do not use this option. Use the default of *Device Default (DHCP)*
- *Receiver IP Address:* Enter the receiver IP address here…only works with IPv4 addresses
- *Receiver Port Number:* Enter the receiver port number here, 49152-65535 private port numbers are recommended

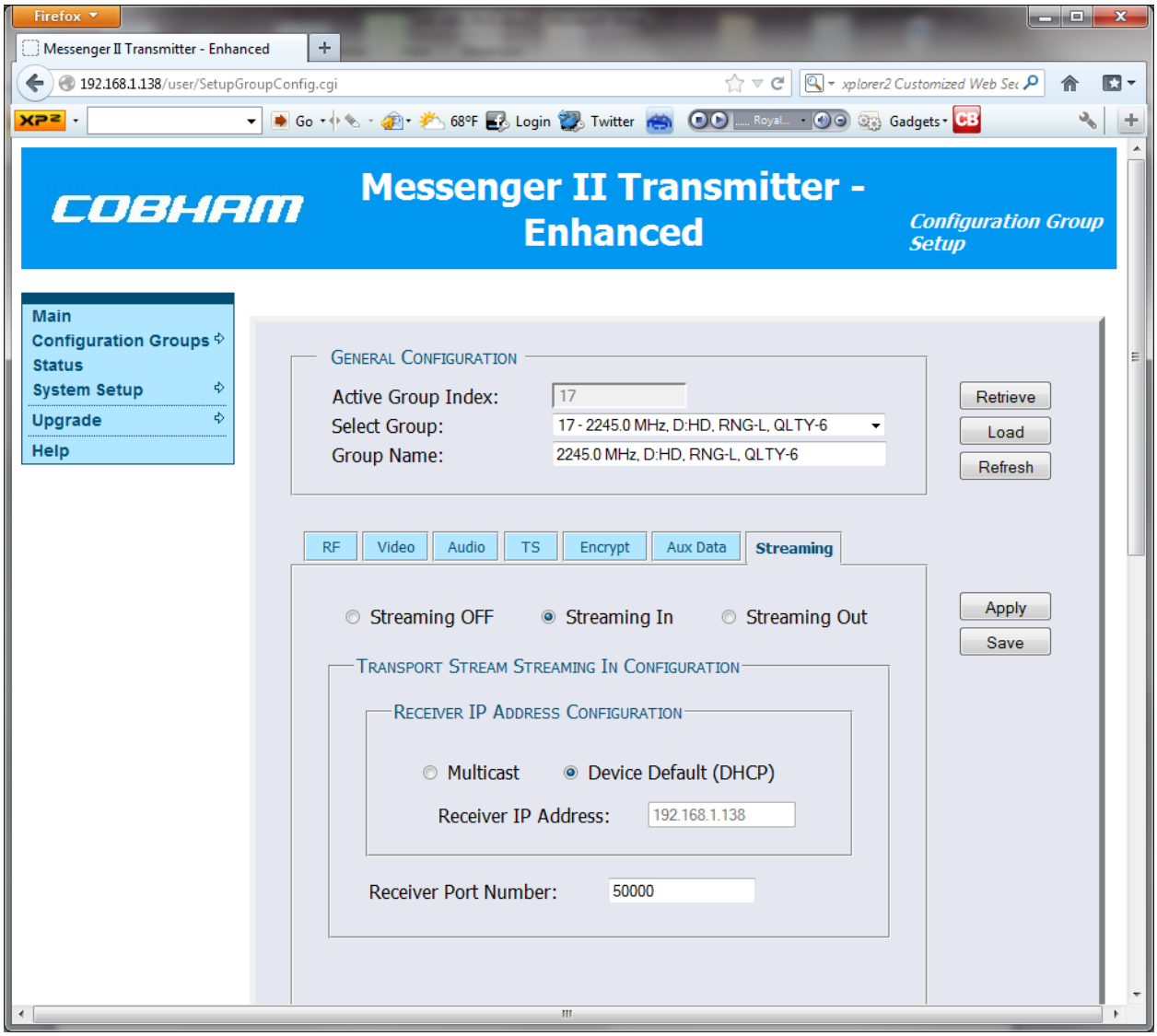


Figure 18 - Individual group configuration page (Streaming-In Tab)

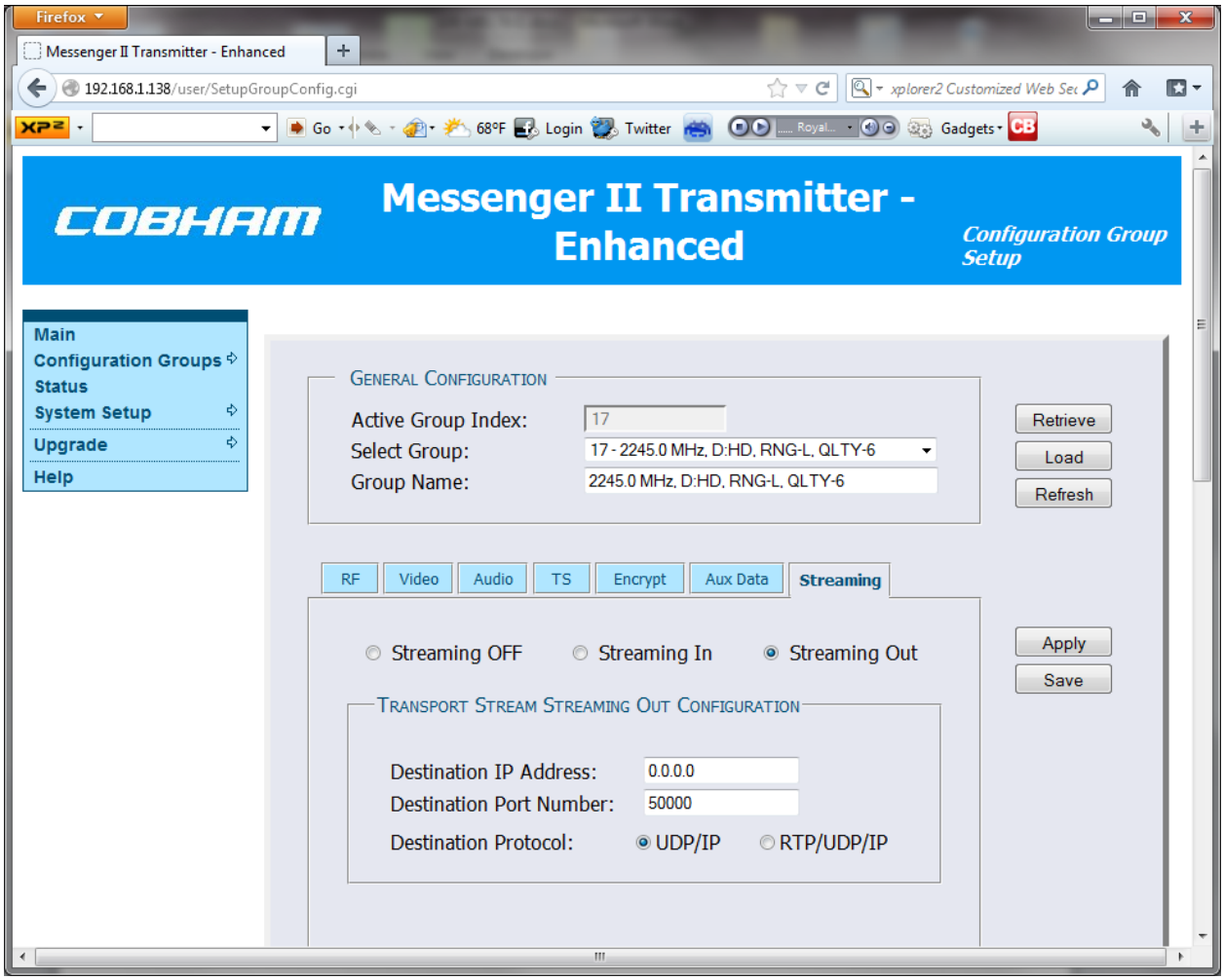


Figure 19 - Individual group configuration page (Streaming-Out Tab)

Inter-Tab Constraints:

General

Because of the *Inter-Tab* constraints changing individual parameters under any of the 7 tabs (located under the Configuration Groups/Setup menu) may affect corresponding parameters under other tabs One way of ensuring stability and reliability of the parameters is to modify the Configuration Group individual parameters (reference section 7.5) as desired and then save the changes as a group (up to 20 groups are allowed) and then load (with the “Load” command) a particular group when the those changes need to be implemented.

Specific Constraints

Taking into account that the *Video* stream is the fundamental constituent of the Transport Stream keep the following guidelines in mind when changing individual parameters.

a) If a dual stream/program is active and the *Video 1 Input Mode* under the *VIDEO* tab is turned ***OFF*** (*OFF* selected from the pull down box) the corresponding **Audio 1 Input Mode** (under the *AUDIO* tab), the corresponding **Aux Data 1** under the *Aux Data* tab and the corresponding **Program 1** under the *TS* tab are all disabled at the same time.

b) With the condition stated above under (a), if the *Video 1 Input Mode* in a dual stream/program is re-activated (enabled) the corresponding **Audio 1 Input Mode** (under the *AUDIO* tab) **remains disabled (*OFF*)**. However the corresponding **Aux Data 1** under the *Aux Data* tab and the corresponding **Program 1** under the *TS* tab are re-activated (enabled if they were previously), keeping in mind because audio is OFF, the audio PID is grayed out under the Program 1 of the TS.

c) Similar conditions as stated in (a) and (b) also apply when using a single stream/program. That is if *Video 1 Input Mode* is active and it is switched over to *Video 2 Input Mode* the corresponding **Audio 1 Input Mode** (under the *AUDIO* tab), the corresponding **Aux Data 1** under the *Aux Data* tab and the corresponding **Program 1** under the *TS* tab are all disabled at the same time. And as stated under (b) if *Video 1 Input Mode* is re-activated the corresponding **Audio 1 Input Mode** (under the *AUDIO* tab) **remains disabled (*OFF*)**. However the corresponding **Aux Data 1** under the *Aux Data* tab and the corresponding **Program 1** under the *TS* tab are re-activated (enabled if they were previously), keeping in mind because audio is *OFF*, the audio PID is grayed out under the Program 1 of the TS.

d) If Video 1 Input Mode is *ON* (and /or Video 2 Input Mode in a dual program/stream) and the corresponding Audio (Audio 1 and/or Audio2) Input Mode is *OFF* the corresponding Audio PID in the Program (Program 1 and/or Program2) in the Transport Stream under the TS tab is automatically turned *OFF* (grayed out).

e) Under the *Streaming* tab, the selection of *Streaming In* forces the Transport Stream Source under the TS tab from *INTERNAL* to *STREAM IN*.

f) If *Streaming In* is currently selected (under the Streaming tab) and if *INTERNAL* is selected as the *Transport Stream Source* (under the TS tab) then *Streaming OFF* is automatically selected (under the Streaming Tab).

g) If *Stream IN* is selected as the *Transport Stream Source* under the TS tab all functions except for the RF parameters under the RF tab, the *Streaming IN* parameters under the Streaming tab and the ASI Out Control under the TS tab are **disabled**.

h) If *ASI* (ASI 1 or ASI 2) is selected as the *Transport Stream Source* under the TS tab the corresponding *Video Input Mode* (Video 1 or Video 2) under the Video tab is shown as **ASI**. If in a dual program/stream mode the second Video Input Mode is *OFF*.

i) If *Streaming In* is selected as the Transport Stream Source under the TS tab, the corresponding Video Input Mode is set to OFF (Video 1 Input Mode is set to *OFF* and in case of a two stream/program Video 2 Input Mode is also disabled). If *Streaming In* is then set to *Streaming OFF*, the Video 1 Input Mode remains *OFF*, however Video 2 Input Mode is then the active video in the case of a single stream/program. In the case

of a two stream/program Video 1 Input Mode remains OFF and Video 2 Input Mode is now the active video.

7.5.2 Configuration Groups File Import

The *import* page can only be accessed at Administrator level. Click on the *Import* option from the *Configuration Groups* item on the menu, the multi-group configuration file import page is displayed, as shown in Figure 20.

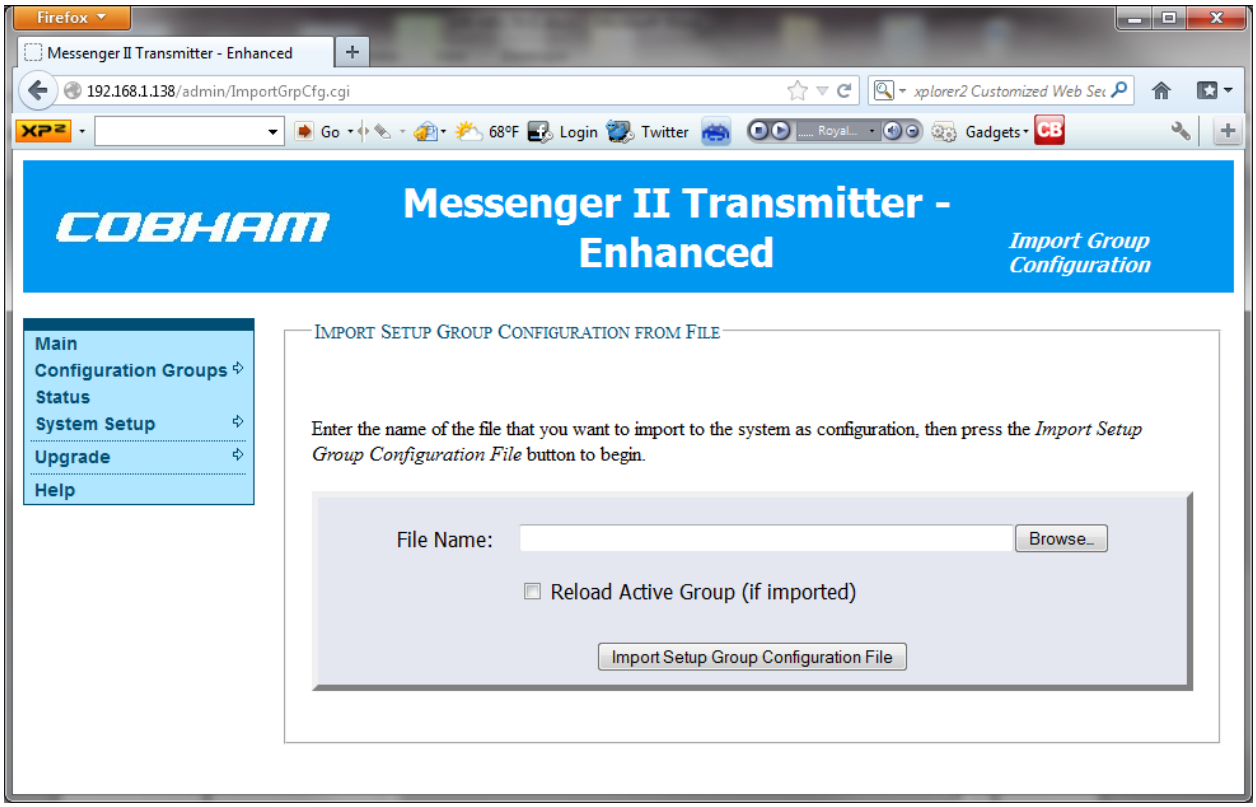


Figure 20 – Multi-group configuration file import

This page provides the user a convenient tool to import a predefined multi-group configuration file from an external storage into the M2TE device without going through individual group setups. In other words a complete set of 20 set-up groups can be imported into the TX with this command. The acceptable configuration file extension is *.m2te*.

To import a file, first, click on *Browse* button to locate the configuration file, and second, click on *Import Setup Group Configuration File* button to proceed.

This import action parses the input file and stores the multi-group configuration parameters into the M2TE database. When the file has been imported successfully, the user can use the individual group configuration web page to display and edit information for each group as needed.

Please note that the import action overwrites the current M2TE database, and should be applied with caution.

7.5.3 Configuration Groups File Export

The stored configuration of all 20 configuration groups in M2TE can be exported to a file on a computer for later use as described in the following. Click on *Export* option from the *Configuration Groups* item on the menu, the multi-group configuration file export page will be displayed, as shown in Figure 21.

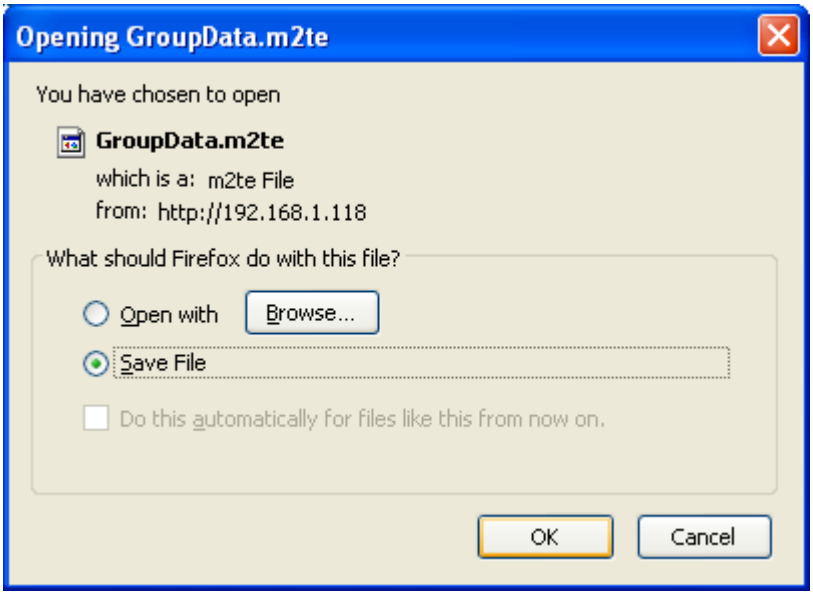


Figure 21 – Multi-group configuration file export through Mozilla Firefox

The export action exports the multi-group configuration parameters from the M2TE database into an external file with the extension *.m2te*, so that this file can be stored externally and ported to different M2TE units.

Please note that this page format is web browser dependent and could appear differently across different web browsers.

7.5.4 Restoration of Default Groups

Click on *Restore Default Groups* option from the *Configuration Groups* item on the menu, the default group restoration page is displayed, as shown in Figure 22.

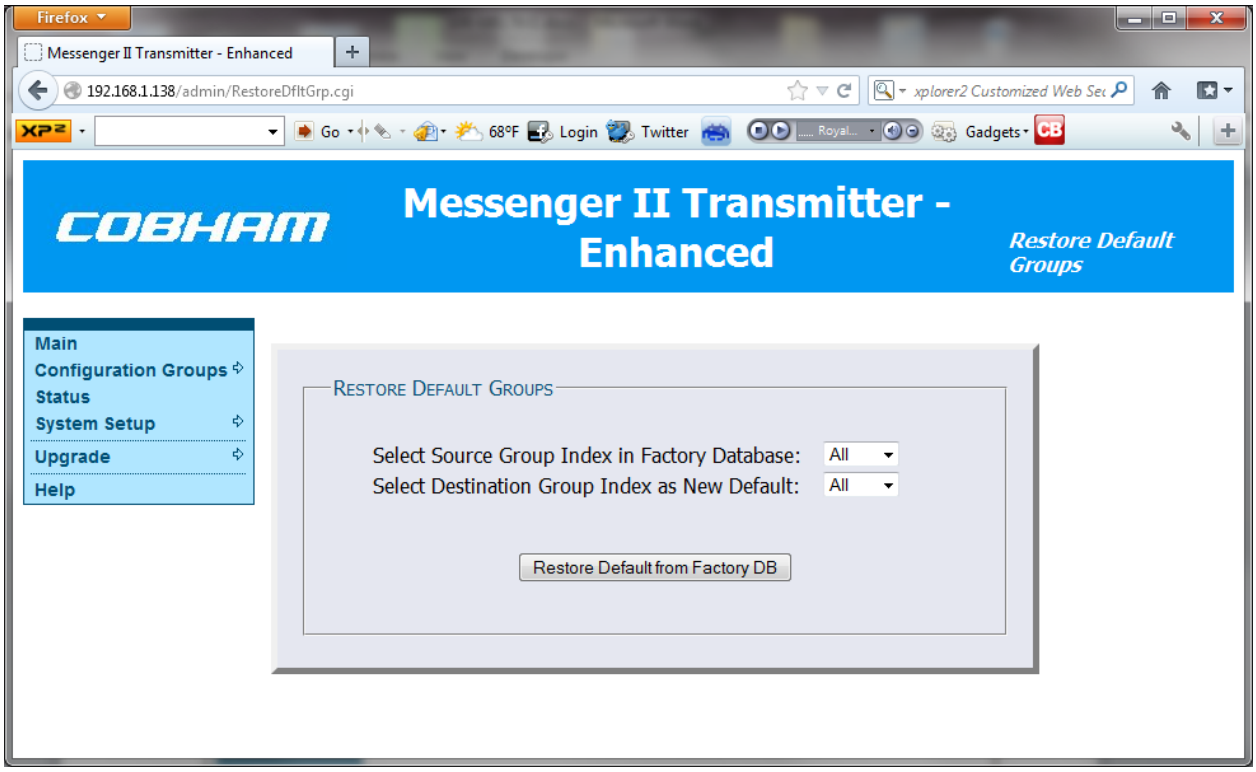


Figure 22 – Restore Default Groups Page

Using the "Restore Defaults Groups, the user can restore the default multiple group configurations from the factory's default setup in three ways:

(1) Restore all twenty group configurations from the twenty default groups defined by the factory.

(2) Restore all twenty group configurations from an individual default group defined by the factory.

(3) Restore an individual group configuration from an individual default group defined by the factory.

7.6 Status

This page, as shown in Figure 23, is intended to provide the user with the current important system configurations, real-time video and audio status, and error information. The user can select the refresh rate (at which the page updates) by using the **Start Refresh** command button at the top of the Status page. If the *Start Refresh is set for "only Once*" then the user must click on the **Start Refresh** button each time for a manual refresh of the current status information.

Note that in the *Audio-Video Formats* table, the video *Lock* means that the auto detected configured format matches the actual detected format. See Figure 23.

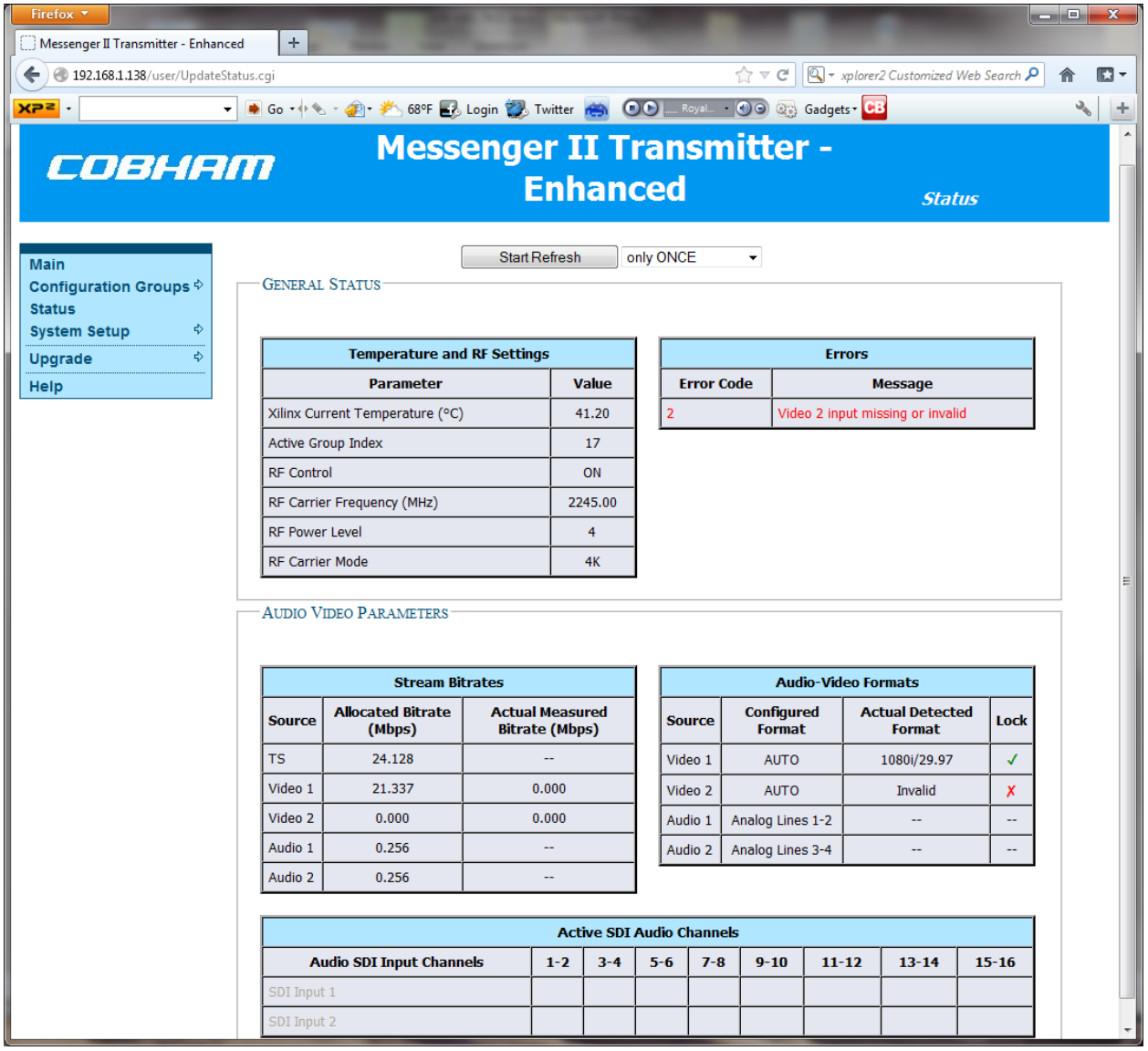


Figure 23 – M2TE Status page

7.7 System Setup

The *System Setup* item on the menu contains the options for the system configurations such as *RF Power*, *Encryption*, *Control Panel*, *Network*, *Serial Port*, and *Logon Update*. These configurations are described below.

7.7.1 RF Power

The *RF Power* page provides a tool to configure RF power **attenuation** values, as shown in Figure 24. The allowable value for each RF power level (0-7dB) is shown in the table. The recommended arrangement for the attenuation values is to make it monotonically decrease as RF power level index increases.

When the ***Apply*** button is clicked, the four RF attenuation values are stored in the system database according to their RF level indexes, and the attenuation associated with the **active** RF level index is activated as well.

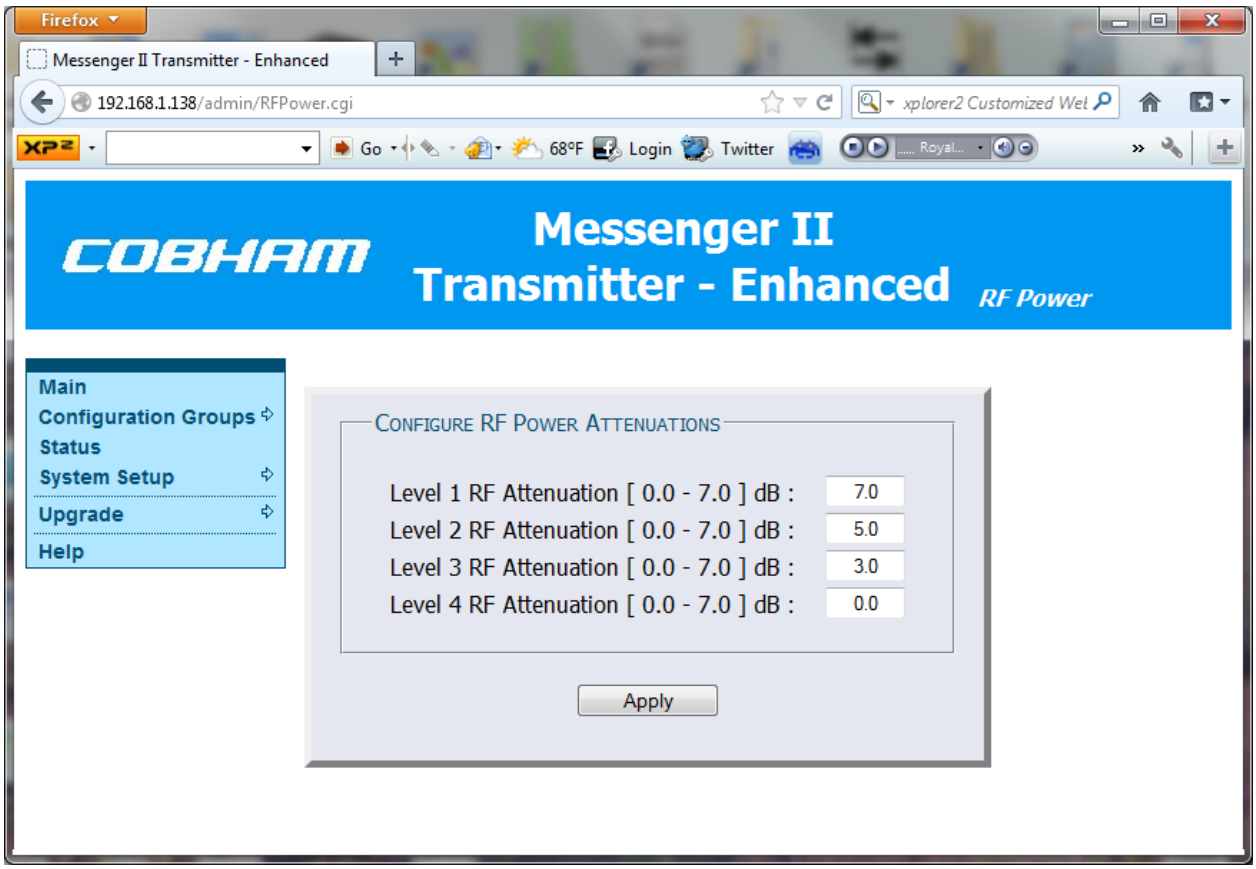


Figure 24 – M2TE RF Power Configuration page

7.7.2 Encryption

The *Encryption* page lets user to configure the encryption key storage type and the five encryption keys, as shown in Figure 25 .

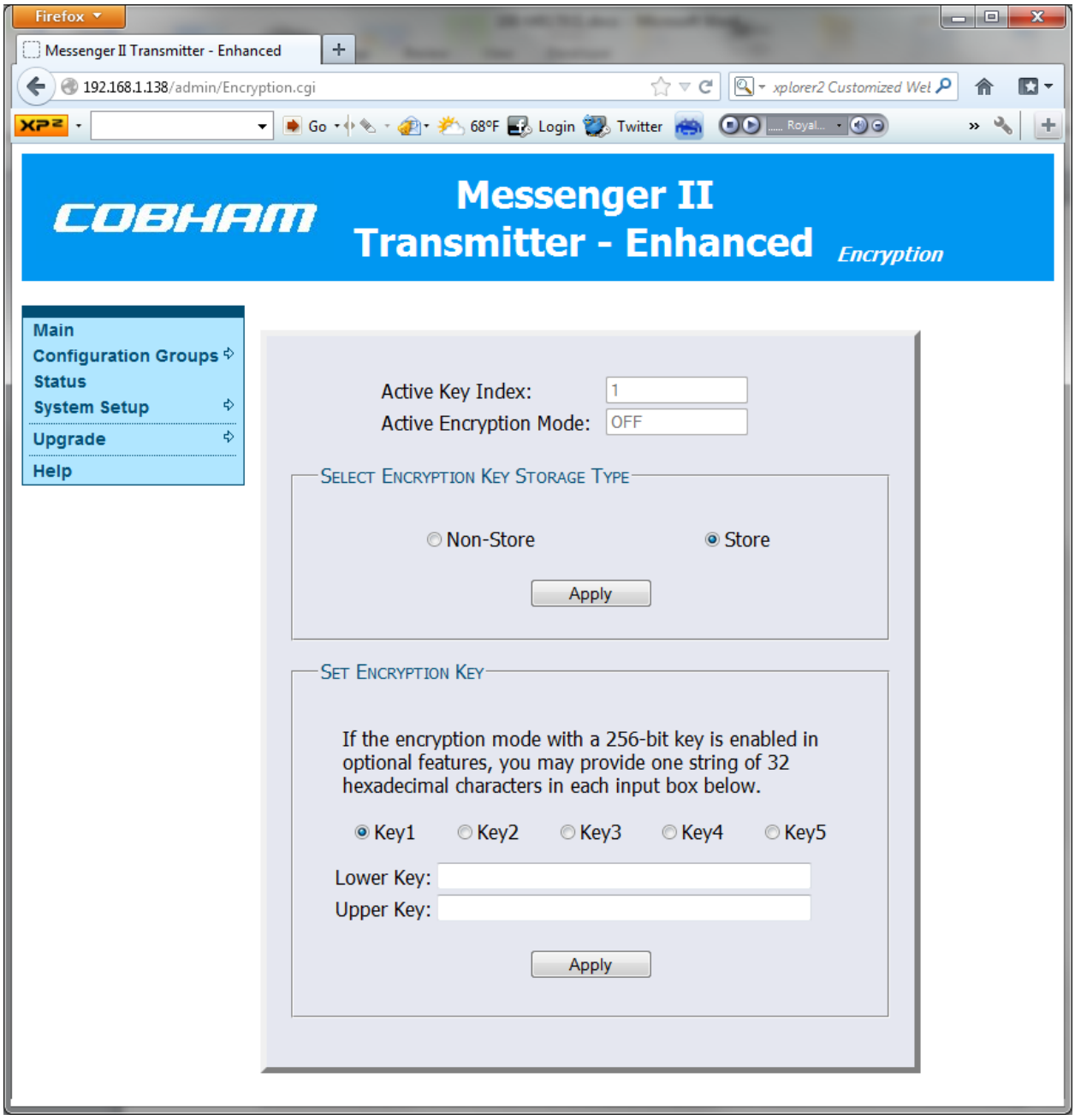


Figure 25 – M2TE Encryption Configuration page

The *Non-Store* key storage type means that the configured keys are volatile and will be cleared at the next time system startup. In contrast, the *Store* key storage type means the configured keys will be stored in the system regardless of cycling the system power.

The 128-bit key consists of one string of thirty-two hexadecimal characters. The 256-bit key consists of two strings of thirty-two hexadecimal characters each. Keep in mind there are now two supported

types of AES encryption, Bcrypt/AES 128/256 and AES-C 128/256. These are purchased options and whichever one is in use ensure the receiver is matched with the same AES encryption type.

Note that the ***Apply*** buttons on this page are independent and they each apply only to the corresponding configuration.

7.7.3 Control Panel

The *Control Panel* page allows user to lock or unlock the local control panel, as shown in Figure 26. When the control panel is locked, user can only retrieve the available status information, and cannot change any settings using the control panel.

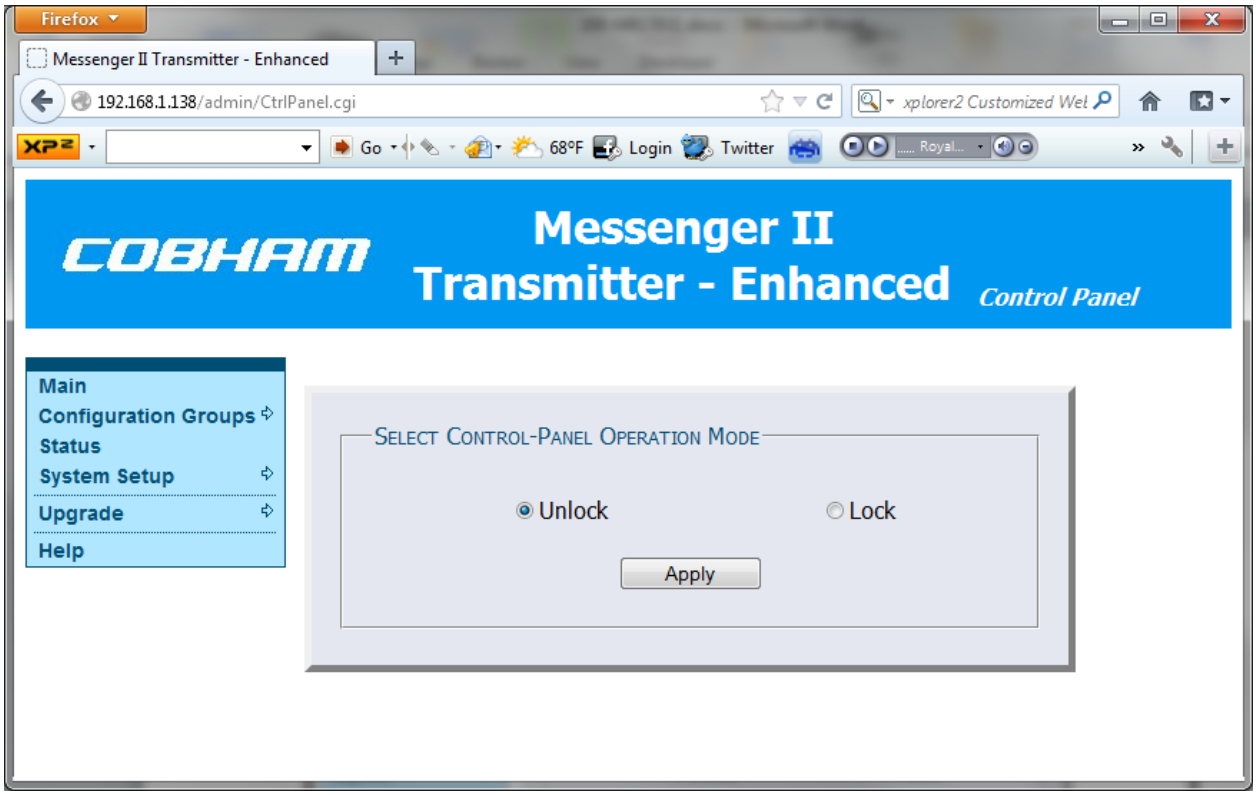


Figure 26 – M2TE Control Panel Configuration page

7.7.4 Network

Under the *System Setup* option on the main menu, select *Network*. A network setup page is displayed as shown in Figure 27.

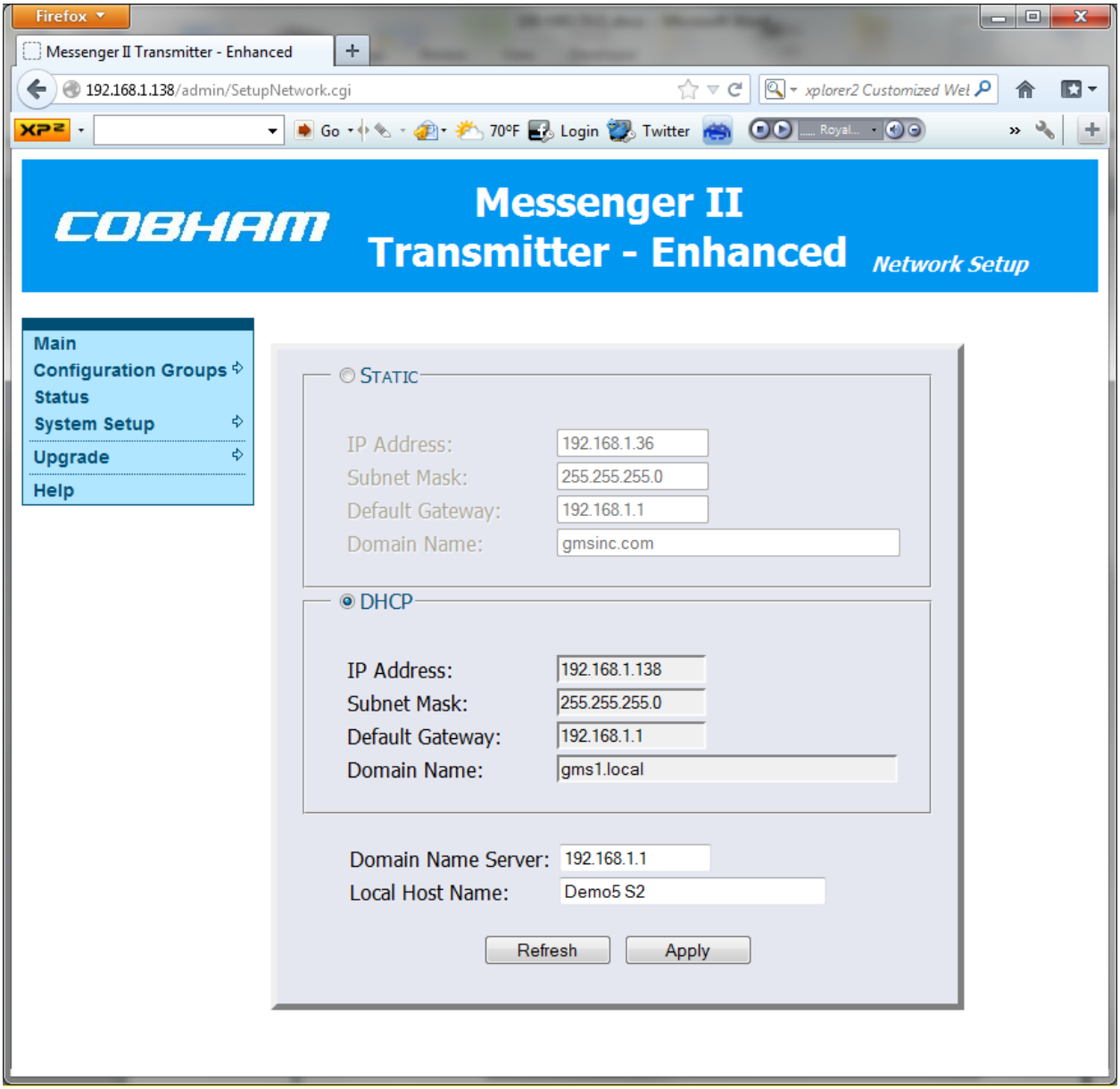


Figure 27 – M2TE Network Configuration page

In the Network Setup page the user can choose *Static* or *DHCP* (Dynamic Host Configuration Protocol) addressing. The default configuration for the M2TE is Static, with an address of *192.168.1.36*.

If the server network to which the M2TE is connected provides DHCP services then it may be more practical to switch to DHCP addressing. With DHCP configuration, the server automatically issues an address to the M2TE.

Please note that addressing is limited to Ipv4 (Internet Protocol Version 4) only.

It is beyond the scope of this manual to explain IP addressing in detail. The user should use caution before changing addressing parameters. Refer to appendix A for additional information on IP addressing and interfacing a personal PC to the M2TE. Also see above sections 6.6.5.1(Report IP Address) and 7.4(Internet Connection).

7.7.5 Serial Port

The *Serial Port* page configures the **available console** serial ports, as shown in Figure 28. Because the serial port will be unavailable for console input when the port is used by other higher-priority applications such as Auxiliary Data Transmission, the note section on the page provides the **currently available** serial ports in bold for console input. The User can refer to this information to choose which serial port to use for console input. Note also if a serial port is configured to accept Binary commands it cannot communicate using the Console commands. Be sure to check the *Interface* mode it's set to.

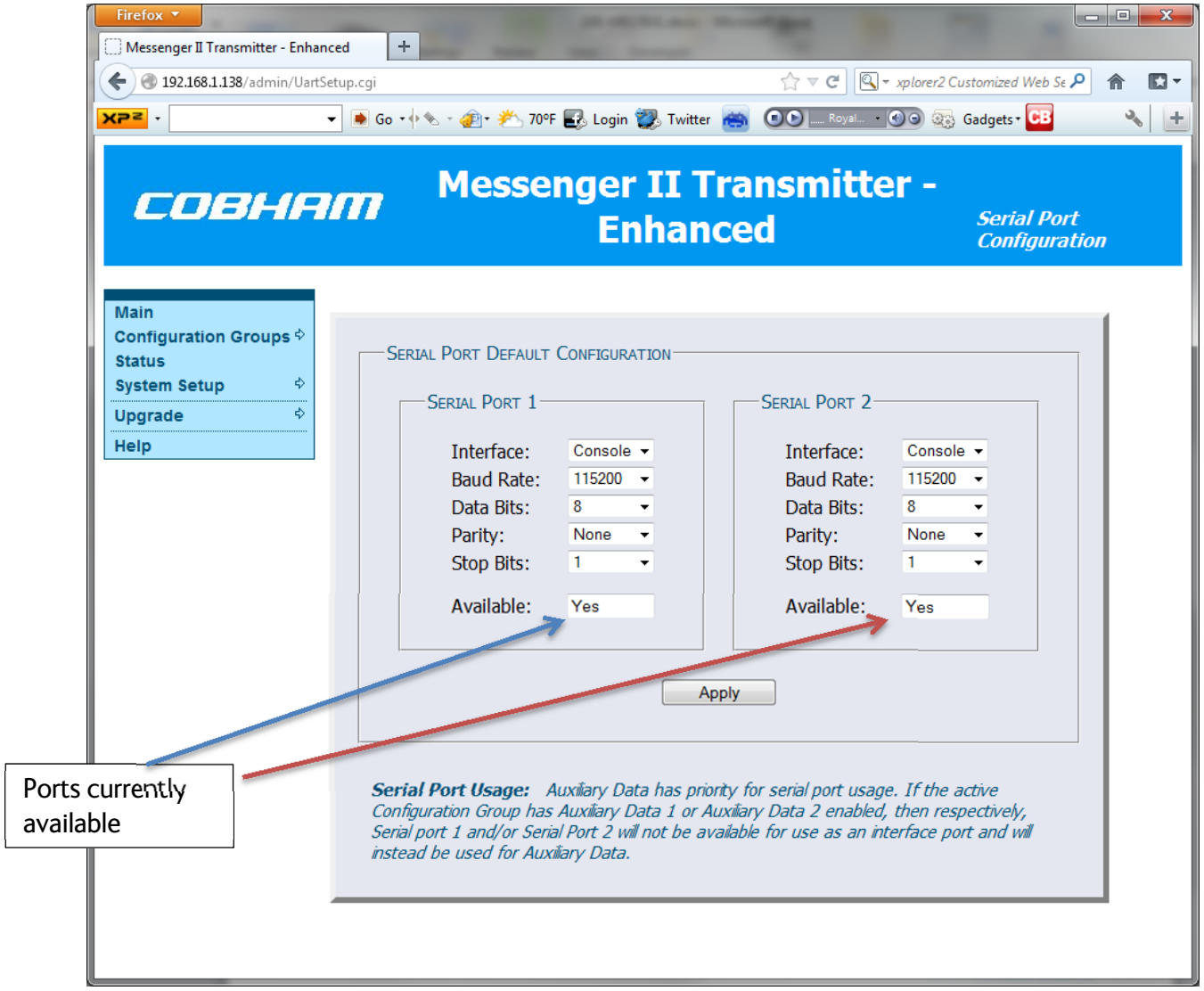


Figure 28 – M2TE Serial Port Configuration page

7.7.6 Logon Update

The *Update Logon* option under the *System Setup* selection on the menu leads to the logon information update page, as shown in Figure 29 . The User level can only update the User account, while the Administrator level user can update both User and Administrator accounts.

Note that in addition to filling in the new account information, the user must **provide** the current logon account name and password in the first two input boxes and then the new account name and password and confirmation of the new password in the remaining boxes.

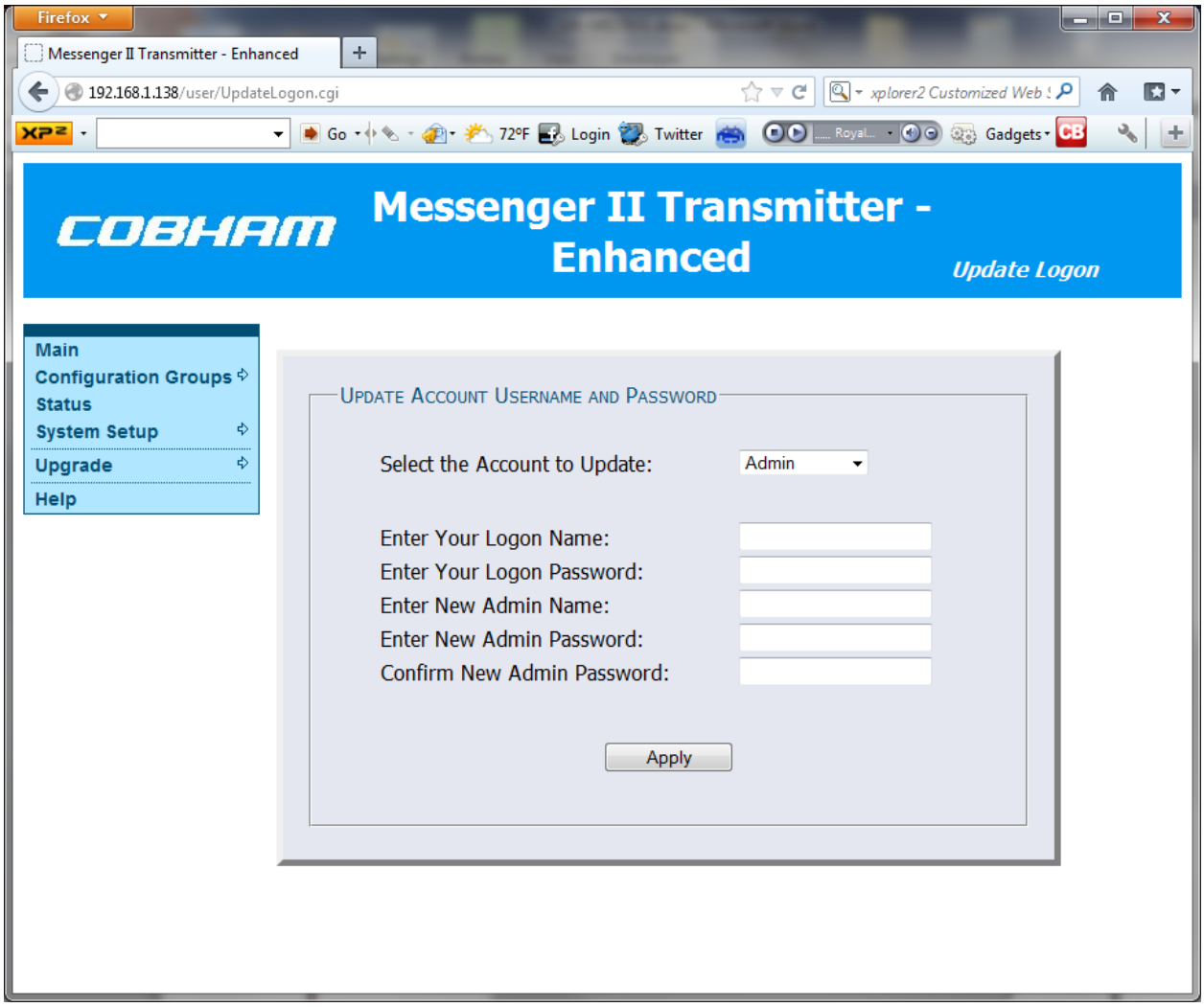


Figure 29 – M2TE Logon Update page

7.8 System Upgrade

The system configuration pages are accessible only at the Administrator level. Put the mouse over the *Upgrade* item on the main menu, the *DSP Firmware*, *Xilinx Firmware*, and *Optional Features* options are shown in the submenu. These options provide fundamental system upgrades; the details are discussed below.

NOTE: *Before upgrading it's wise and strongly recommended to export the existing 20 configuration groups (see section 7.5.3 on file exporting) especially if the groups have been modified. After upgrading the firmware you can then import the 20 configuration groups or just individual ones (see section 7.5.2 on file importing). In this way you can avoid having to modify the groups again if they were previously modified.*

7.8.1 Firmware Upgrade

M2TE allows user to upgrade the new firmware through the web user interface. The *Upgrade* selection on the main menu contains two firmware upgrade options: *DSP firmware* and *Xilinx firmware*, whose pages are shown in Figure 30 and Figure 31, respectively.

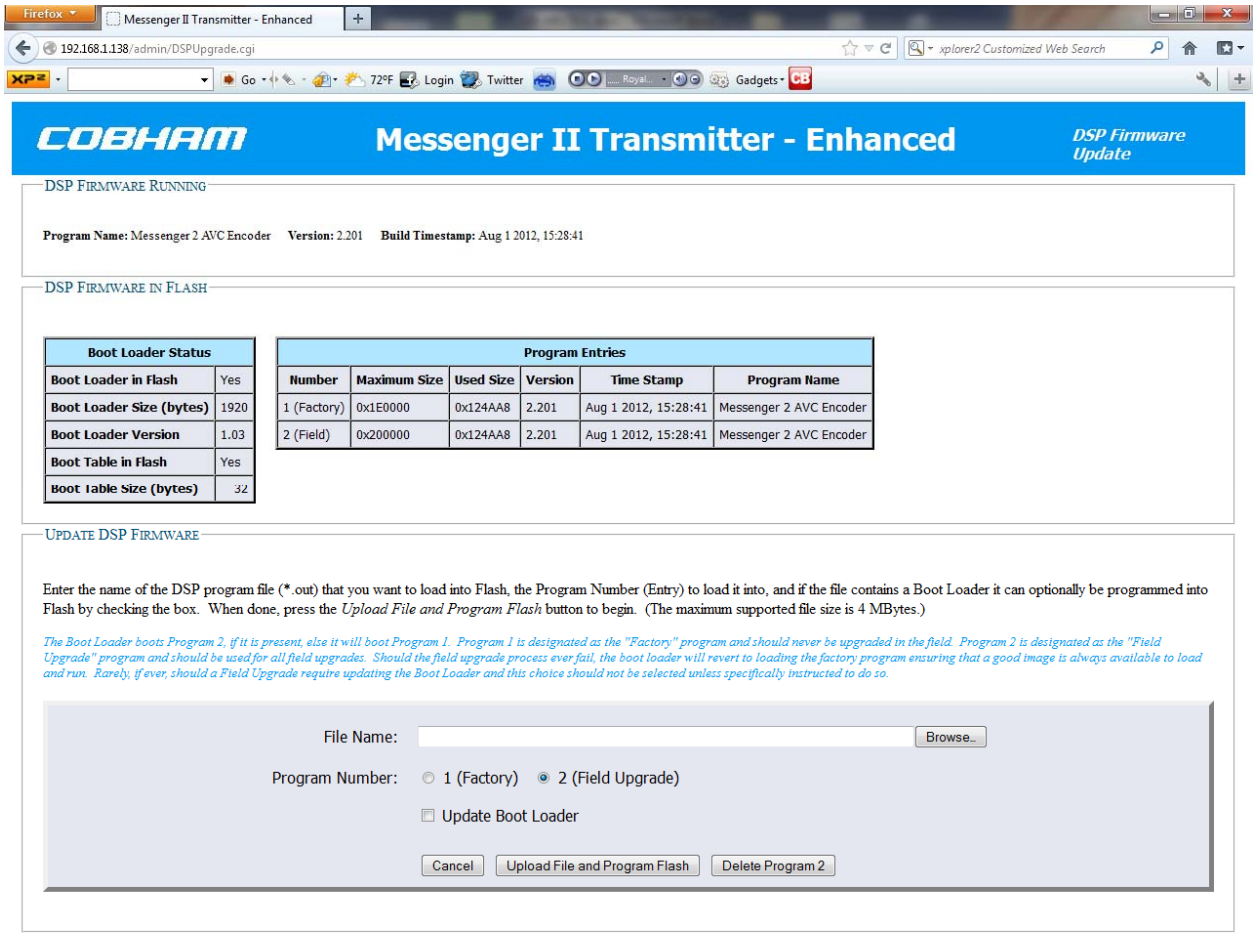


Figure 30 - M2TE DSP firmware upgrade page

DSP Firmware Upgrade:

The DSP program file extension is "*.out*" and it is stored in the Flash memory of the M2TE and activated in the DSP at the system start-up.

To update the DSP firmware, the user needs to enter the file name (under *File Name* text box) of the DSP program file (*.*out*) and the *Program Number* to load it into, and if the file contains a *Boot Loader* it can optionally be programmed into Flash by checking the box. When done, press the *Upload File and Program Flash* button to begin.

The *Boot Loader* boots from Program 2 if it is present, otherwise it will boot from Program 1. Program 1 is designated as the *Factory* program and should never be upgraded in the field. Program 2 is designated as the *Field Upgrade* program and should be used for all field upgrades. Should the field upgrade process ever fail, the *Boot Loader* will revert to loading the factory program ensuring that a good image is always available to load and run. Rarely, if ever, should a *Field Upgrade* require updating the Boot Loader and this choice should not be selected unless specifically instructed to do so.

Note: *If upgrading new DSP firmware ensure to load the corresponding Xilinx firmware (if there is one to be upgraded) as discussed in the next section before re-powering the transmitter.*

Xilinx Firmware Upgrade:

The Xilinx program file extension is "*.bit*" and it is stored in the Flash memory of the M2TE and activated at the system start-up.

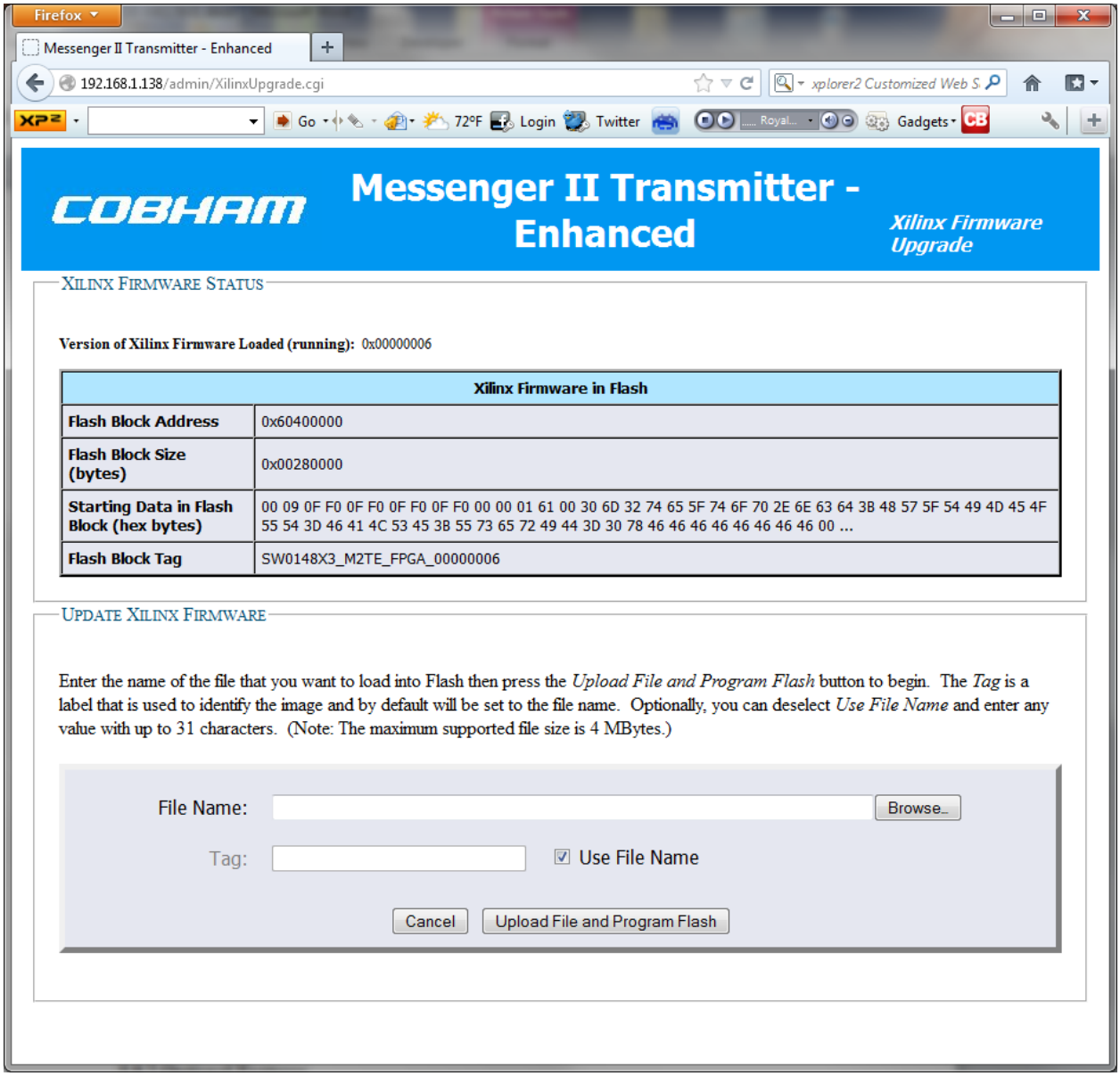


Figure 31 – M2TE Xilinx firmware upgrade page

To update the Xilinx firmware, the user needs to enter the name of the desirable file (*.*bit*) and then press the *Upload File and Program Flash* button to begin. The *Tag* is a label that is used to identify the image and by default will be set to the file name. Optionally, the user can deselect *Use File Name* and enter any value with up to 31 characters. Please **note** the maximum supported file size is four Mbytes.

7.8.2 Optional Features

Current factory enabled options can be viewed by selecting the *Optional Features* under the *Upgrade* item on the main menu in the web user interface, as shown in Figure 32. New features can

be enabled by entering a 32-bit *Upgrade Code Word* on the same page, which is supplied by customer service. Except for *Auxiliary Data* the features shown in Figure 32 are purchased options. *Auxiliary Data* is provided at no charge as well as *Embedded Audio* which is not listed as a feature.

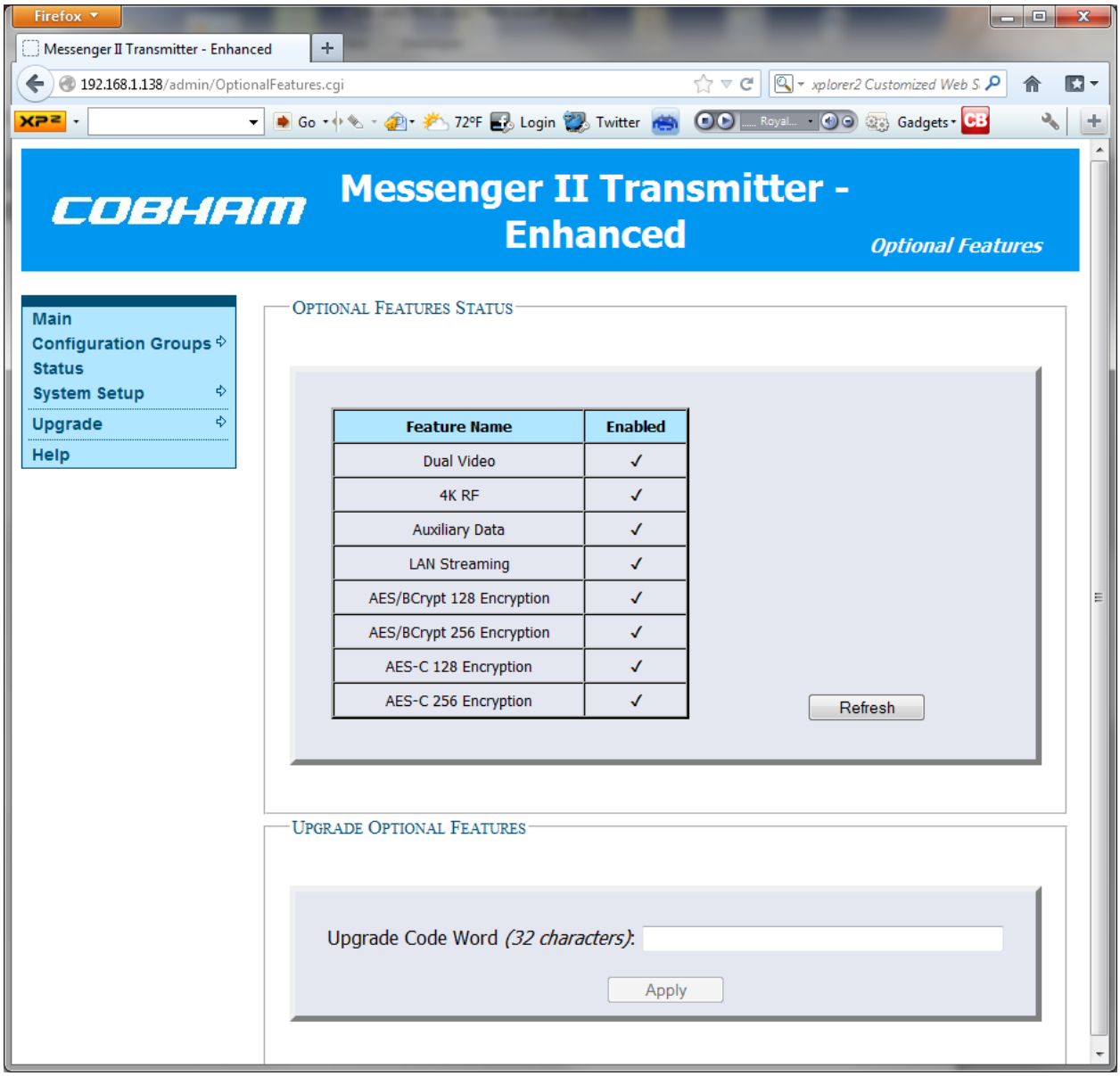


Figure 32 – M2TE optional feature page

The top section on the page shows the current enabled features (these will vary depending on which if any options are purchased). And the bottom section is where the 32-bit *Upgrade Code Word* can be entered to enable additional optional features that are purchased. The unit should be re-powered

after adding new features. New features which are enabled should be verified on the same page upon re-powering the M2TE.

7.9 Help

As shown in Figure 33, the *Help* page provides general information such as the firmware versions, production information, optional feature status, and *M2TE* online support link.

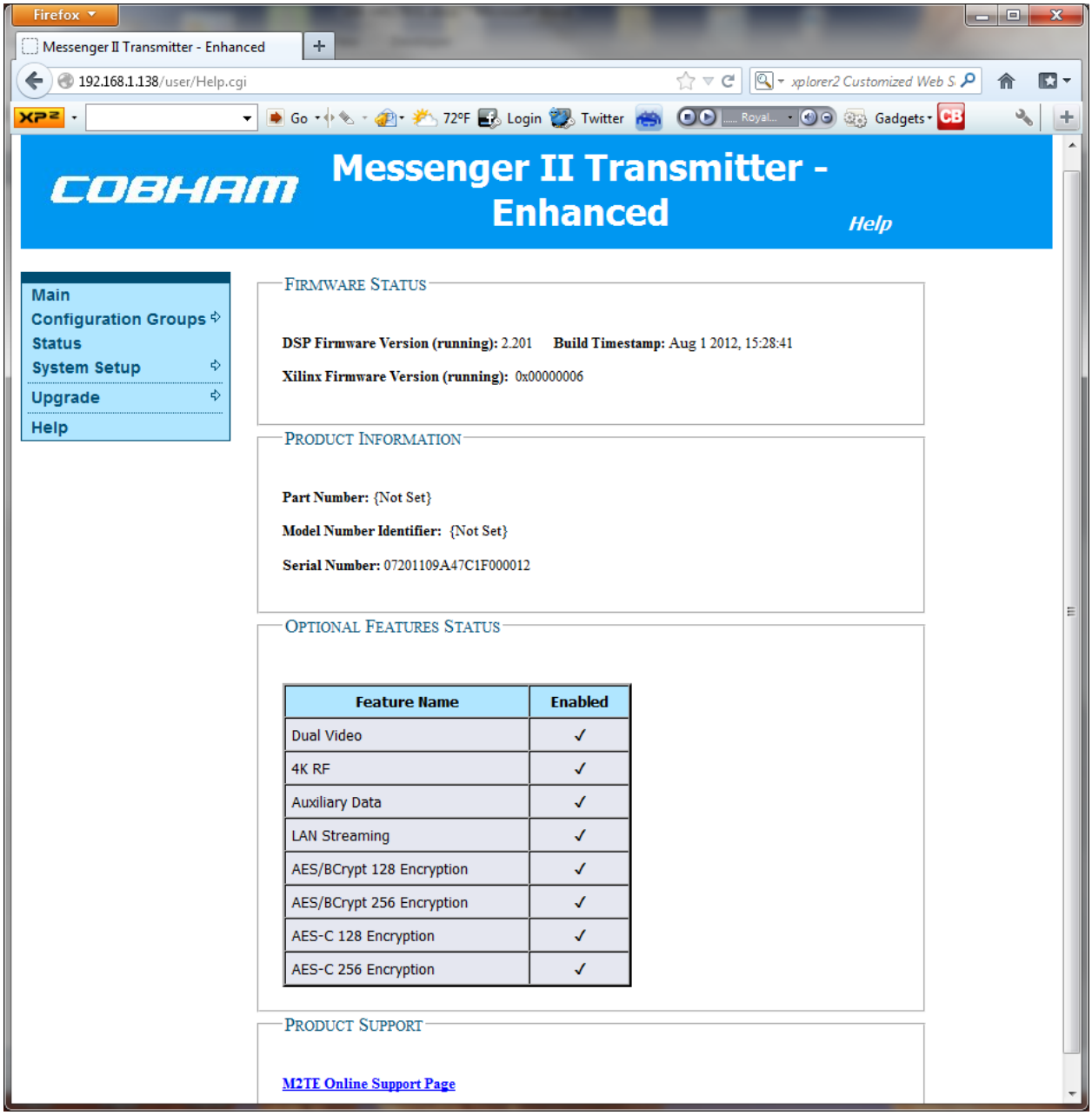


Figure 33 – M2TE Help page

8. Initial Checkout

Included Items

The standard M2TE kit includes the following items:

- M2TE unit
- M2TE full breakout cable (Cobham part number 780-C0526 or 780-C0554) (A/V input, Auxiliary Data, Control interfaces)

NOTE: Based on customer application Cobham may deliver a receiving system, additional cables and antennas. Contact Factory for further information.

The M2TE is pre-configured by Cobham prior to shipment (based on customer requirements), thus is ready to work "right out of the box".

8.1 Getting Started

Prior to installing a M2TE unit into the desired target environment, an initial checkout should be performed to ensure proper operation of the unit. The initial checkout consists of configuring a basic MT2E link.

Figure 34 – Basic M2TE Link Setup shows a basic standard single program M2TE wireless link configuration. (NOTE: MSR and Block Down-Converters & M2D units and their associated hardware are sold separately). The steps necessary to setup the configuration shown in Figure 34 – Basic M2TE Link Setup are shown below. High throughput (4K) optional M2TE require additional hardware (which includes two MSRs, a DDP plug in card and a combiner).

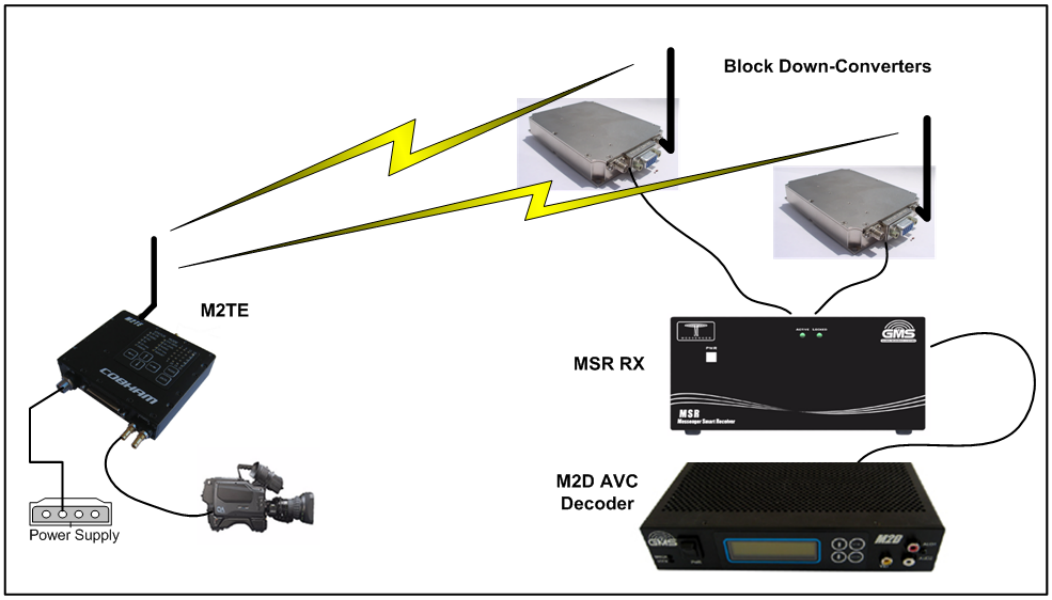


Figure 34 – Basic M2TE Link Setup

1. Install Omni-directional antennas onto the M2TE transmitter RF output port and at the receiver end Down-Converter(s) RF input port. ***Note: Transmitters should not be powered on without a load attached to the RF output connector. The internal PA could be damaged.***
2. Attach an SDI video source to the M2TE's SDI 1.0/2.3 video input #1. A composite signal can also be applied to the M2TE's I/O – Control VHDCI-68 connector using Cobham break out cable,
3. The MSR should be pre-configured from the factory (refer to the Cobham web site for the online manual). In short ensure the MSR is powered, has a cable from the ASI out to the decoder ASI input, that each tuner has a RF cable which runs to each block down converter (each tuner is provided power either through the MSR or locally) and is set to the same RF frequency as the transmitter.
4. Attach a video cable from the video out of the decoder to a video monitor. Refer to the decoder's operational manual for proper setup.

   NOTE: Before providing power to the M2TE in the following step ensure to use a proper heat sink with adequate air flow or equivalent heat sinking method.
5. Provide power to the M2TE (+12 Volts) using Cobham break out cable which connects to the I/O – Control VHDCI-68 connector. Power supply should be able to source approximately 2 amps.
6. Turn on the video source and video monitor equipment.
7. Insure that the M2TE is set to Set-up Config Group #1. Refer to Section 6 for full Local Control Panel operating instructions.
8. After approximately 30 seconds the link should be established and video provided by the source should be displayed on the monitor. An optional computer with the MSR control software installed can be used to monitor the receive parameters such as BER, MER and Signal to Noise. This connection can be through the USB or RS232 port.

The initial checkout described above is simply to check the basic video operation of the M2TE unit. For further details on monitoring and controlling the M2TE using the M2TE's WEB-based control and status indicator, see section 7.

9. Specifications

RF Output

Output Frequency: 1 to 7 GHz (In-Bands)
Frequency Resolution[9]: 100 KHz or 1 MHz
Frequency Accuracy: (+/-) 2.5 ppm (High-G Crystal Optional)
Bandwidth: Selectable
6, 7, 8 MHz Standard
12, 14, 16 MHz Optional
RF Output Power: ≤ 20 mW to 200 mW,
Adjustable
Output Impedance: 50 Ohms with VSWR <1.5:1
Connector: SMA-F

Video Encoding (HD)

Video Processing Capability: Single Video input, Dual Video Inputs (processing of each input can be independently set for all encoder parameters)
3D Modes: Content collection (Separate inputs from two cameras that are GENLOCKed)
Interfaces: Dual HD-SDI/SDI or Dual HDMI (Option)[10]
HD-SDI Standards: SMPTE-292M, -296M, -274M, -424M
HD-SDI SDI Connectors: 1.0/2.3 mm (75 Ohm) 3Gbps
Compression Standard: AVC / H.264
(Per ISO/IEC 14496-10 with interlaced extensions)
Motion Est. Range: (+/-) 192 Horiz., (+/-) 128 Vert.
Video formats/resolutions supported:

Format	Resolution @ Frame Rate
1080i 1080PsF	1920x1080@23.98/24/25/29.97/30 fps 1920x1080 @ 23.98/24/25/29.97/30 fps
1080p	1920x1080@23.98/24/25/29.97/30 fps
720p	1280x720 @ 50/59.94/60 fps

Variable GOP Structure: I-only and IP
PsF supported with INTERLACED FORMAT
Profiles supported: BP@HL with interlaced extensions
HDMI Version: Optional[10]
Video bit rates: HDTV to 50 Mbps[11]
System Latency: down to <44 mS (Ultra-Low Latency Mode) [12]
Frame Rate Reduction 1/3, 1/15, 1/30, 1/60

Video Encoding (SD)

Video Processing Capability: Single Video input, Dual Video Inputs (processing of each input can be independently set for all encoder parameters)
3D Modes: Content collection (Separate inputs from two cameras that are GENLOCKed)
Interfaces: Dual SDI and Dual Composite or Dual HDMI[10]
SDI Standards: SMPTE-259M
SDI/ Composite Connector: 1.0/2.3 mm (75 Ohm) [Same as HD-SDI connector]
HDMI Version: Optional[13]

[9] Frequency Band dependent
[10] In development, future update
[11] With 4K High-Throughput Option on M2TE or Encoder Mode
[12] Latency Delay is Decoder dependent
[13] In development, future update

Compression Standard: AVC / H.264
(Per ISO/IEC 14496-10 with interlaced extensions)
Motion Est. Range: (+/-)192 Horiz., (+/-) 128 Vert.
Video format standards: NTSC or PAL

Format	Resolution @ Frame Rate (frames per second)
576i	720x576 @ 25/29.97 fps (PAL)
480i	720x480 @ 25/29.97 fps (NTSC)

Variable GOP Structure: I-only and IP
Profiles: BP@ML with interlaced extensions
Video bit rates: to 25 Mbps[14]
System Latency: down to <44 mS (Ultra-Low Mode)[15]
Frame Rate Reduction, 1/3, 1/15, 1/30, 1/60

Audio Encoding

Analog Audio Inputs:
Qty 4 Total, Two Dual, Line-Level and Dual Mic-Level, Single-Ended or Differential, Clip Level 12 dB
Mic Bias: 5 V
Input Impedance: 100K Ohms
Standards: SMPTE-272M, -299M
Digital Audio: Dual Embedded (2-channel) per Video input
Embedded Audio Format: SMPTE 299M
Compression Standard: MPEG-1 Layer 2
Bit rates: 256 Kbit/s per channel.
Sampling Frequency: 48 KHz
THD: < 1 % max.
Response: 20 Hz to 12 KHz, (+/-) 0.25 dB
Crosstalk: >55 dB min
S/N: >50 dB RMS
Connector: P/O Multipin Connector

[14] With 4K High-Throughput Option on M2TE or Encoder Mode
[15] Latency Delay is Decoder dependent

Transport Stream
Standard: per ISO/IEC 13818-1
Packet Size: 188 Byte
Format: AVC / H.264/ MPEG-4 Part 10 encapsulated into an MPEG Transport Stream
Specification: ITU-T Rec. H.222.0 Amendment 3
Bit Rate: Automatically set from active service settings.
ASI Output
Connector: 1.0/2.3 mm (75 Ohm)

Modulation
Modulation Type: COFDM w/QPSK, 16-QAM,
or 64-QAM

Standard: DVB-T compliant
FEC: 1/2, 2/3, 3/4, 7/8
Guard Intervals: 1/32, 1/16,1/8,1/4
COFDM Carriers: 2K Carriers

High Throughput Option
FEC: 1/2, 2/3, 3/4, 7/8
Guard Intervals: 1/32, 1/16, 1/8, 1/4
COFDM Carriers: 4K Carriers

Program Identification
The unit allows the user to set-up a unique Provider Name and Service Name for each active program.

Scrambling Option
Type: 128/256 Bit Advanced Encryption Standard (AES)
Key Storage: User Controlled, volatile or non-volatile

AUX Data Option
Protocol: RS-232C, Asynchronous, 8/7 Bits, No/Even/Odd-Parity, 1 Stop Bit
Data Rate: Selectable, Up to 115200 KBaud
Aux Data PID: Selectable
Connector: P/O Multipin Connector

Time Stamping[16]
Processes External VANC extracted UTC#1 and SMPTE-12M time stamps from the digitized Video stream input of the HD-SDI/SDI input interface. The secondary UTC#2 is also generated using an external 1PPS signal and EIA-232/422 serial configuration commands.

Key Length Value (KLV) Metadata[17]

[16] In development, future update
[17] In development, future update

Implementation of the KLV Metadata meets standards set **by the National Geospatial-Intelligence Agency (NGA)** Motion Imagery Standards Board (MISB). The KLV Metadata is input into the M2TE either via embedding it in the VANC space of the HD-SDI/SDI input interface and/or the separate serial RS-422 interface.

Time Stamp Processing[17]

The Picture Timing SEI messages allow each Video frame to be assigned a time value. This time can represent time of origin, capture or alternative ideal display. As such, it can be used to navigate to a frame with a particular time.

The H.264 format, specified in ISO/IEC 14496-10 provides for an optional time stamp to be defined in the Supplemental Enhanced Information (SEI) message. The picture timing SEI message (pic timing) specified HH:MM:SS:FF IAW RP 0604 page 5. Additionally, the standard allows for Auxiliary data to be associated with a particular Video frame using the Auxiliary Data Unregistered SEI Message. The primary M2TE time stamp UTC#1 is inserted into the pic timing SEI element of the NAL packets in the H.264's output stream. The secondary M2TE time stamp UTC#2 is a 64 bit value indicating the number of microseconds since August 23rd 1999 and is inserted into the unregistered user data SEI element.

Output Requirements

Serial Output[17]

The M2TE outputs MPEG-2 TS data with the following format:

- EIA-422 SSI Synchronous Serial Interface IAW EN 50083-9
- Output Video data rate from 128kbps to 10.7 Mbps 1 kbps resolution.
- The M2TE outputs an MPEG-2 compliant Transport Stream (TS) that not only contains H.264 compressed motion imagery, but also contains time-synchronized metadata and compressed Audio.
- The MPEG-2 TS output of either EIA-422 (constant bit rate) or Ethernet format operates at a bit rate ranging from 128 kbps to 10.7Mbps adjustable in 1 kbps increments.
- The M2TE is able to operate with an external clock input from the RF communications data link as well as with its own internal clock source.

Ethernet Streaming

The M2TE contains an IEEE 802.3u 10/100Base-TX Ethernet interface. The MPEG-2 TS can be encapsulated in UDP/IP packets IAW RFC 3984. The M2TE is configurable to send Multicast IP packets without receiving a join request.

RTP/UDP/IP and UDP/IP are the preferred protocols in transmitting multimedia data across networks that use the Internet Protocol (IP). RTP (Real Time Transport Protocol) operates at the Application layer and relies on User Datagram Protocol (UDP) at the Transport layer. It applies sequence numbers to indicate the order in which packets should be assembled at their destination. UDP is preferable to the Transmission Control Protocol (TCP) for real-time applications because it offers low-latency transport (less overhead) across IP networks.

Physical

Dimensions: 3.6" x 3.12" x 0.767"
(8.61 cu Inches)
9.14 cm x 7.92 cm x 1.91 cm
(13.83 cu cms)

Environmental:
Operational Temperature: -10˚C to +70˚C
(EXTERNAL COOLING REQUIRED)
Humidity: Up to 95% non-condensing

Weight: 8 oz. (227 grams)

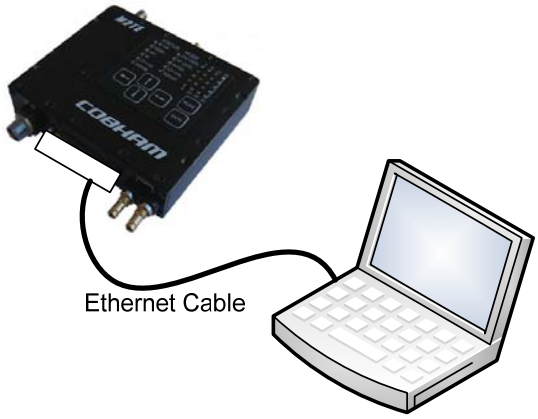
DC Power

DC Voltage Range: 9 -32 VDC
Power Consumption: ˜14 to ˜16 Watts
(Operating mode & Band Dependent)

Control Local – Easy to use local control and status panel allows up to 20 user-defined operating modes covering most programmable parameters including Center Frequency, 4 Range Settings (defined modulation settings), Mic/Line Level Audio, Encryption ON/OFF, and status of Video In and RF Out.

Remote Control & Status – M2TE can be controlled through Control Application. Supported via WEB server provided through the LAN interface.

Appendix A - IP Static Addressing and Interfacing to a Personal Computer



☞***Note:*** Refer to sections **6.6.5.1** (Report IP Address), **7.4** (Internet Connection) and **7.4**(Changing Network Configuration) on how to obtain current IP address from the front M2TE panel control, how to obtain and or change IP address through the serial port and how to change the network configuration using the LAN interface respectively.

Also as noted previously in the manual the M2TE only supports Internet Protocol Version IPv4. It also supports Auto-MDIX (Medial Dependent Interface Crossover). In general it means a crossover IP cable is not needed when it is plugged into a network or a personal PC.

A.1. Static

The M2TE transmitter leaves the factory with a static IP setting of ***192.168.1.36***. Interfacing to a personal computer involves setting the PC to a static address with the same IP class (and network ID) as the M2TE which is a class C (beginning octet is in the range of 192-223). By setting the PC to a static address with the same IP class and network ID it will recognize the M2TE and it will be able to talk to it. The following steps show how to set the PC to a static address.

The example below is from a Windows 7 operating system. An XP operating system is similar. The object is to get to the properties of the Local Area Connection, select the properties of the "Internet Protocol Version 4 (TCP/IPv4)' or "Internet Protocol (TCP/IP)" in the case of an XP operating system and then check "Use the following IP address" and set it to a class C address with the same network ID as the M2TE.

- From the desktop click on the Windows start button and select the "Control Panel". See Figure 35 below.

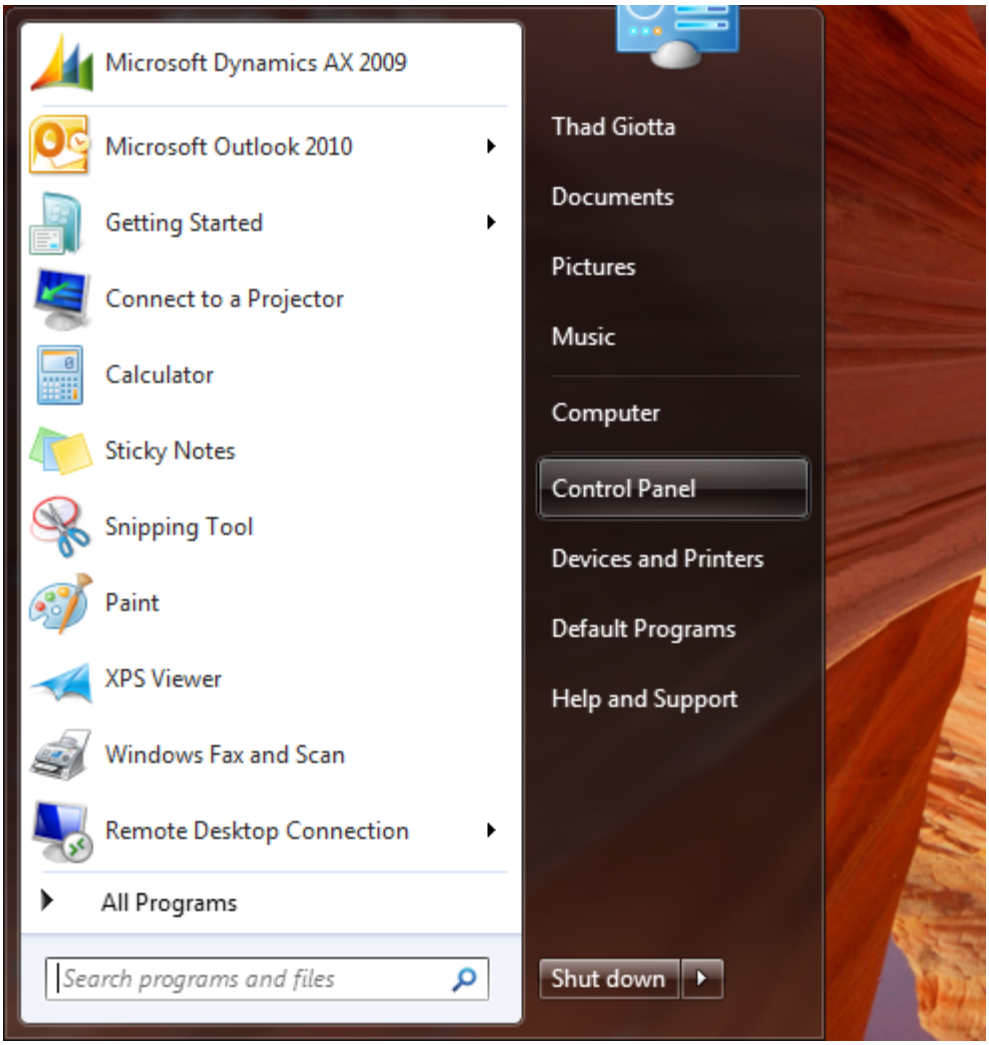


Figure 35 - Windows Start Button

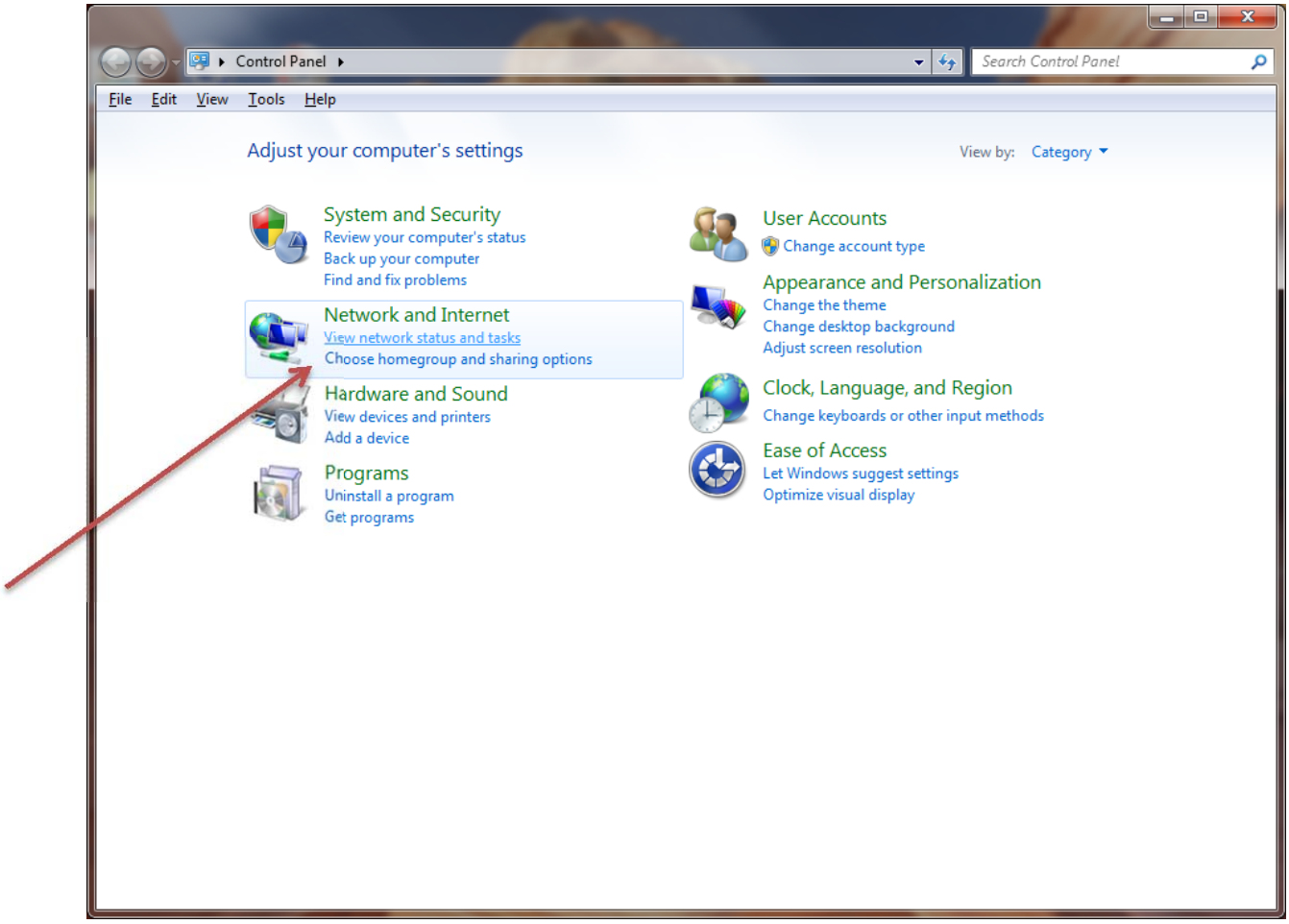


Figure 36 - Control Panel

- From the Control Panel under the "Network and Internet" Icon click on the "View network status and tasks". See Figure 36. You may need to select the Control Panel "Category" view to see the picture similar to the Figure 36.

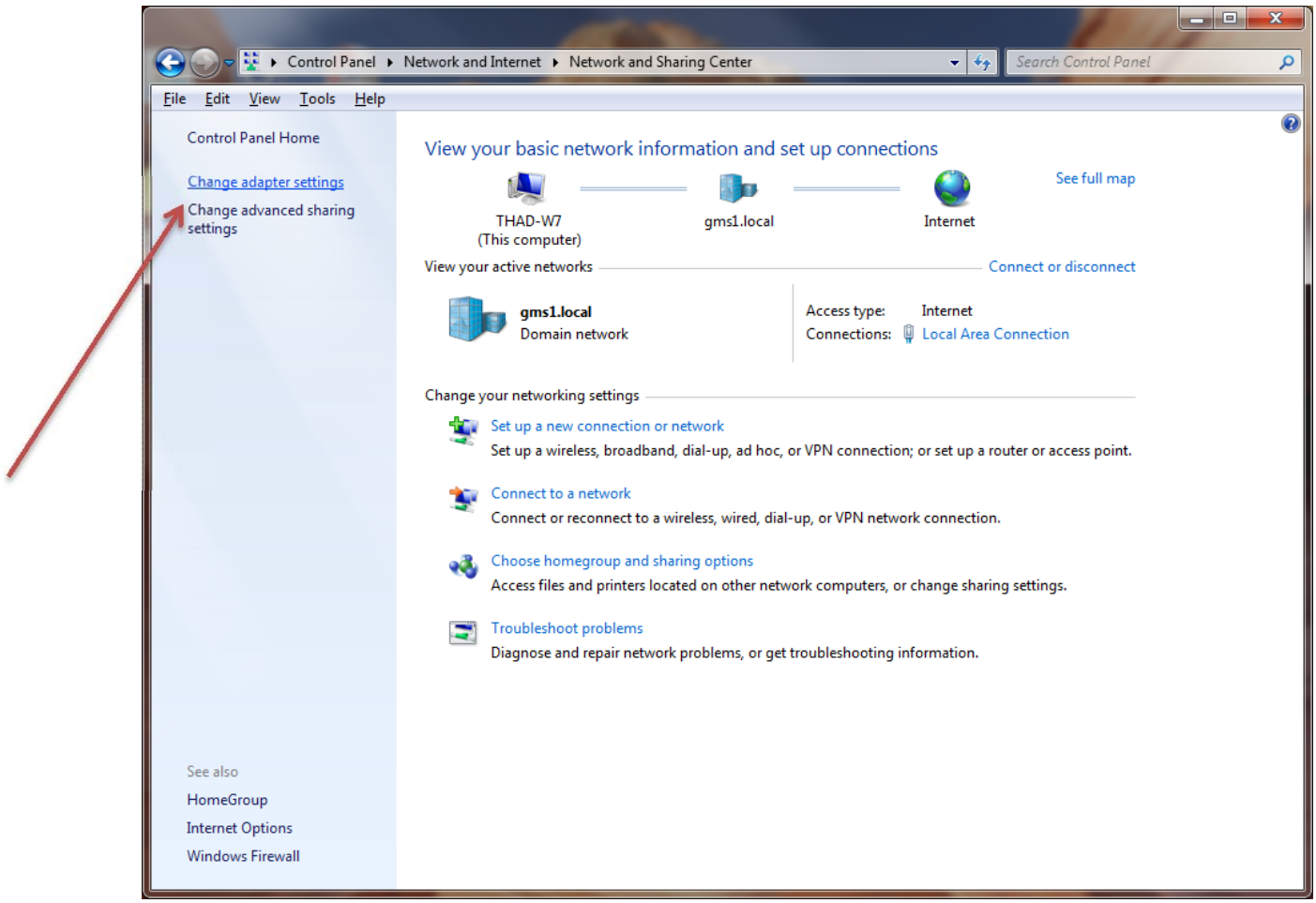


Figure 37 - Network Center

- Click on the "Change adapter settings" on the left side of the screen as shown in Figure 37.

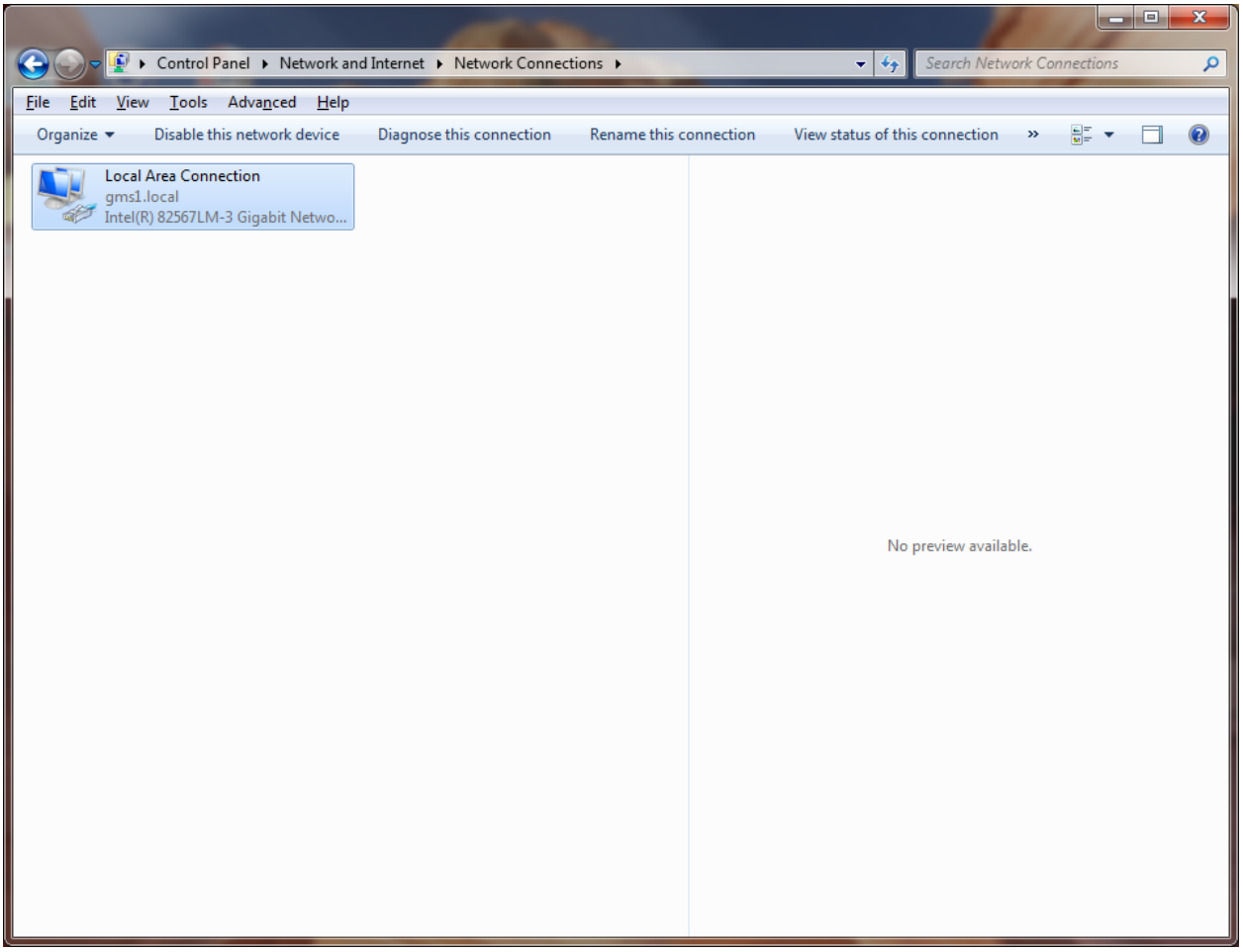


Figure 38 - Network Connections

- Right click on the “Local Area Connection” icon and select properties.

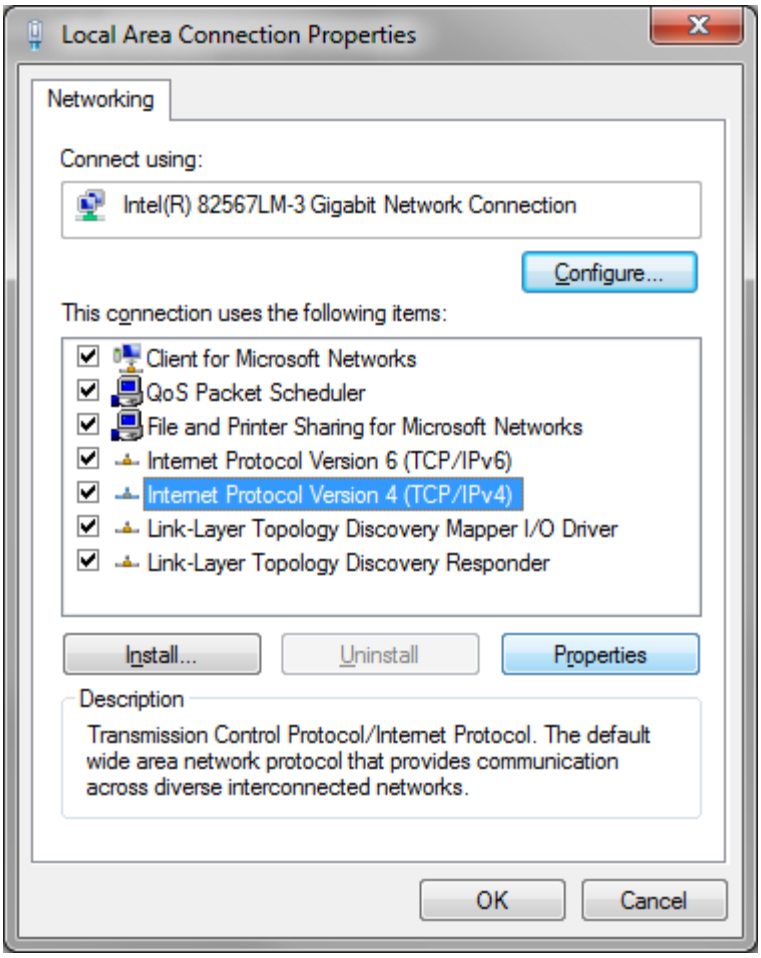


Figure 39 - LAN Properties

- Select the "Internet Protocol Version 4 (TCP/IPv4) or in the case of an XP system "Internet Protocol (TCP/IP)" and then click on the "Properties" button as shown in Figure 39.

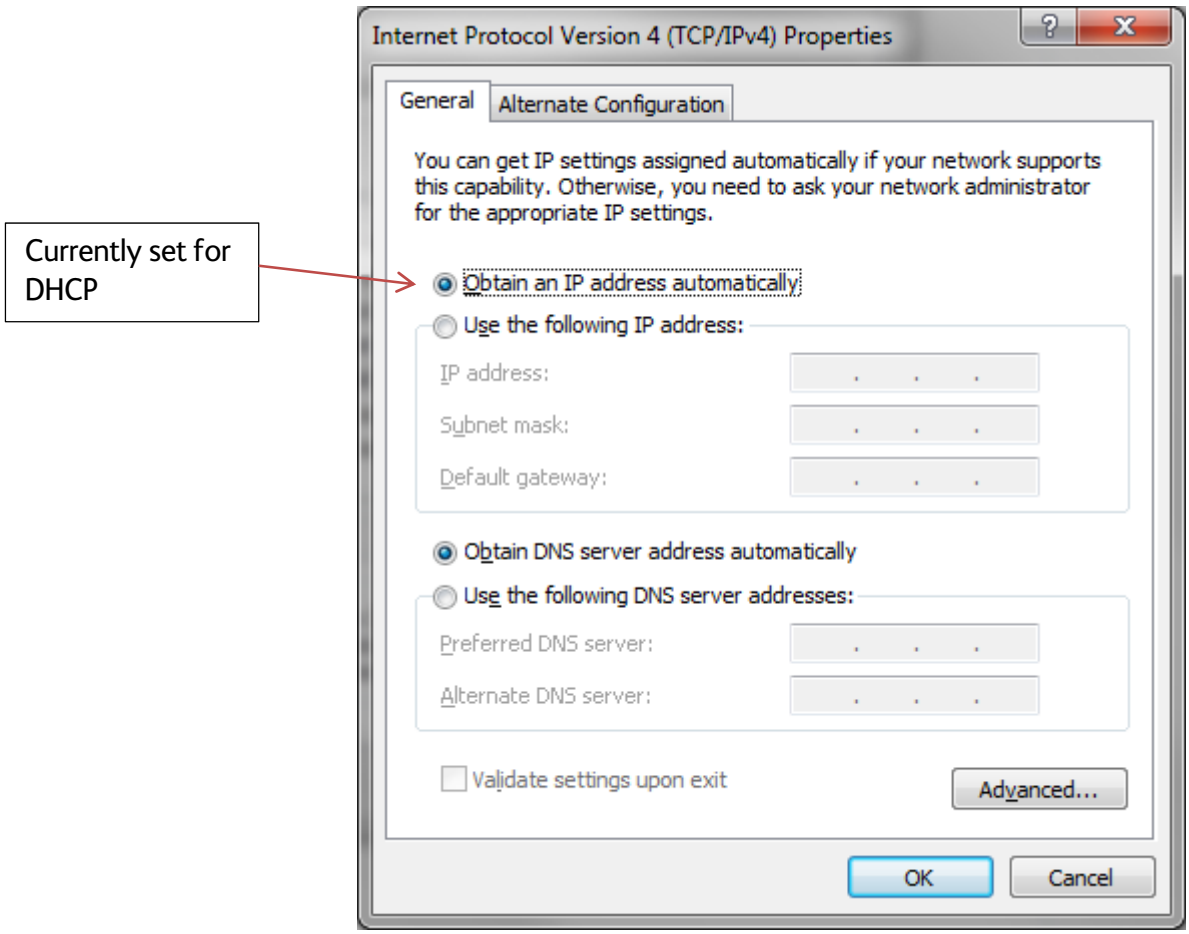


Figure 40 - TCP/IPv4 Properties

- The default setting for many PCs is DHCP addressing as shown in Figure 40.
- Check the "***Use the following IP address*" *radio button*** .This sets the PC for static addressing. Then enter a class C address such as ***192.168.1.20*** under the" IP address" text box. Click in the "Subnet mask" text box and the PC should automatically set the subnet mask associated with the class C addressing. See Figure 41.

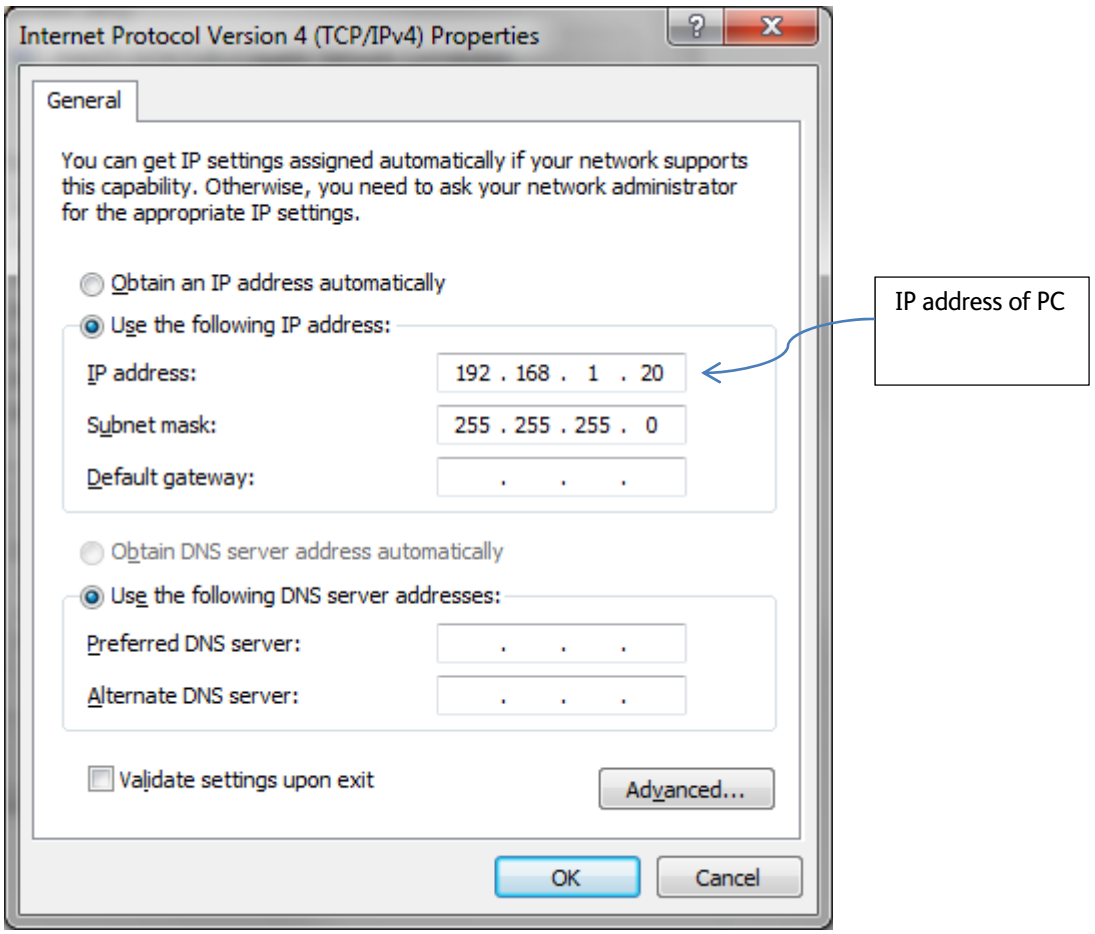


Figure 41 - Static IP Address

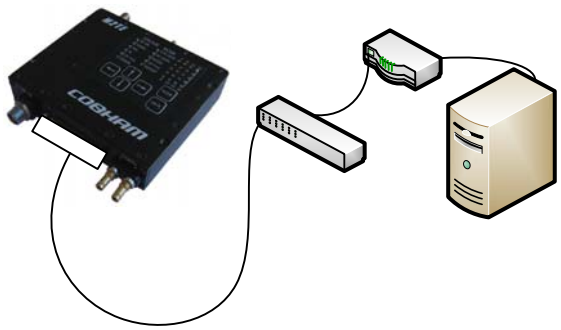
- That is all that is needed to be able to communicate with the M2TE. Make sure to click on the "OK" button and then exit the properties window. You should now be able to open a Browser such as Microsoft IE and type in the default IP address of the M2TE (in this example it is ***192.168.1.36***) and it should be able to talk to it (make sure to plug in the IP (Ethernet) cable from the M2TE to the PC).

Keep in mind the following:

- The IP address set for the PC as shown above in Figure 41 is *its* static IP address (192.168.1.20), ***do not enter the IP address of the M2TE here***. The IP address of the PC must be different from the M2TE IP address; you cannot have two different devices with the same IP address on a network. The "*192.168.1*" portion of this address shows that it is a class C address with a network ID of ***192.168.1.0*** The ".20" portion states the *host* information. Host information can be set from 1 to 254. Zero (0), and 255 are usually reserved or have special meaning, so do not use them. Hence as long as the network ID is the same as the M2TE the PC will be able to communicate with the M2TE. So I could set the IP address of the PC to 192.168.1. **<1-254>** and it still would be able to communicate with the M2TE. For example instead of using 192.168.1.20, I could use 192.168.1.30 or 192.168.1.5 or 192.168.1.60, etc.

- Since the static IP address of the M2TE also has a network ID of ***192.168.1.0*** (its IP address is **192.168.1**.36) the PC is able to communicate with it.
- Remember IP addressing can be much more involved and complicated but the above example should be enough to get things working.

A.2. DHCP (Dynamic Host Configuration Protocol)



- DHCP is an automated means of assigning a unique IP address to a device on a network. The M2TE can be set up for DHCP, see section **7.7.4.** If the server network to which the M2TE is connected provides DHCP services then it may be more practical to switch to DHCP addressing.
- Keep in mind if the M2TE is set up for DHCP addressing then each time the it gets attached to the computer network the IP address may change (depending on the configuration of the DHCP server; the IP addresses that it issues are leased for an limited amount of time, once the leased has expired a new IP address may be issued). Hence when the M2TE IP (Ethernet) cable is attached to the computer network it may be necessary to find the current IP address. See section **6.6.5.1** "Report IP Address".
- Also be aware if the M2TE is set for DHCP addressing and the IP (Ethernet) cable of the unit has not been attached to a computer network then the reported IP address will show all 0's, for example 0.0.0.0. If this is the case make sure to attach the M2TE IP cable into the network which has a DHCP server and that the M2TE has been set for DHCP addressing.

Finally remember that through the serial port, see section **7.4** you can view the current IP settings, the current addressing mode and the current IP. In addition you can change the mode and set a static IP address using the serial port.

Appendix B - Cable, M2T External Breakout Cables

REVISIONS

ECO	REV	DESCRIPTION	DATE	DRAWN	CHKD	PRO ENG	ENG MGR	MECH ENG	DOC
SEE SHEET 1 FOR APPROVALS AND DEATILS									

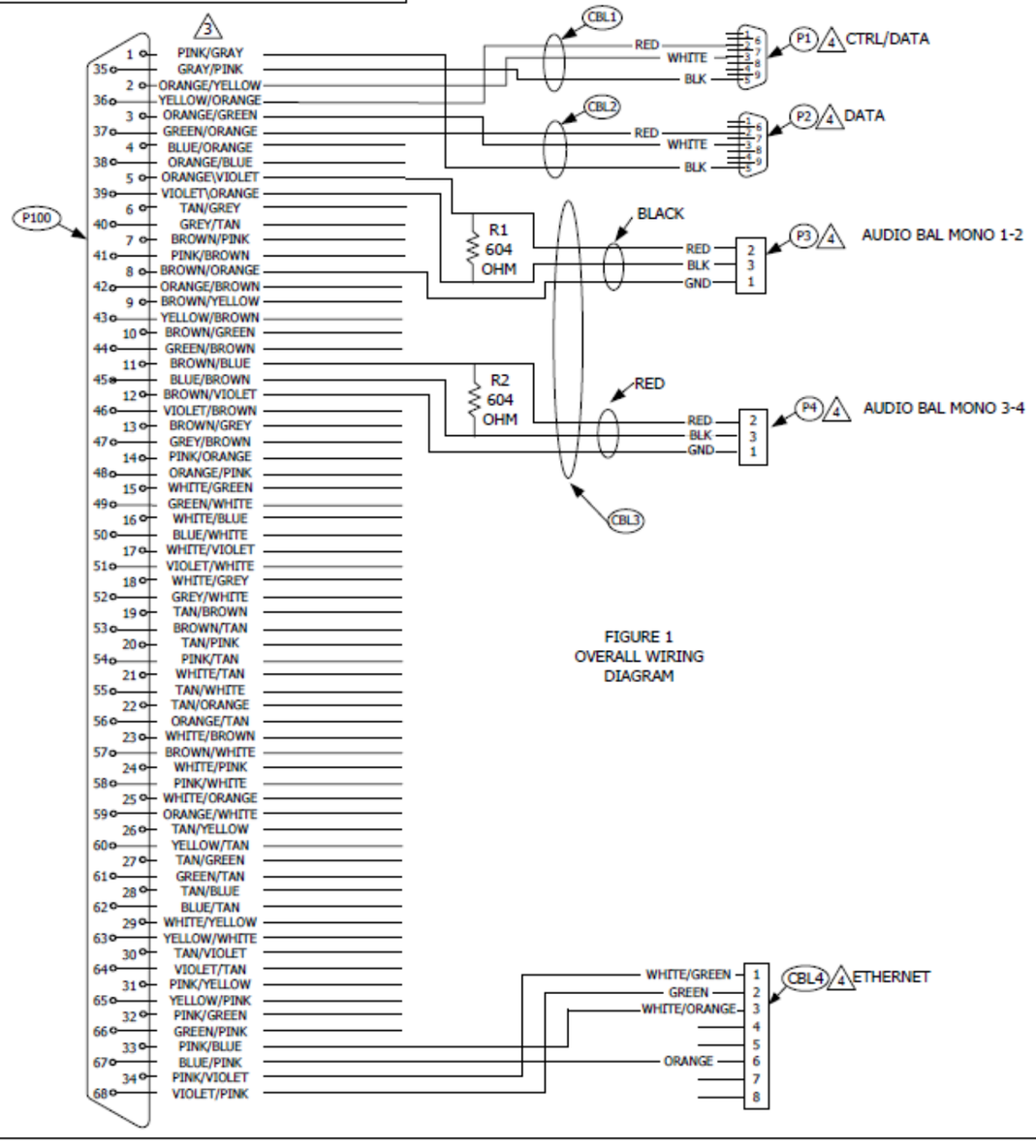


FIGURE 1
OVERALL WIRING
DIAGRAM

COBHAM
GMS INC. DBA COBHAM TACTICAL COMMUNICATIONS AND SURVEILLANCE
1916 PALOMAR OAKS WAY #100, CARLSBAD, CA 92008
www.cobham.com/tcs

DWG TITLE: CABLE,M2TE,BREAKOUT,CTL,XLR

SIZE	DWG NO	REV
B	100-C0526X4	X4

SCALE	NONE	VISIO DWG	SHEET	2 OF 5

REVISIONS									
ECO	REV	DESCRIPTION	DATE	DRAWN	CHKD	PRO ENG	ENG MGR	MECH ENG	DOC
SEE SHEET 1 FOR APPROVALS AND DETAILS									

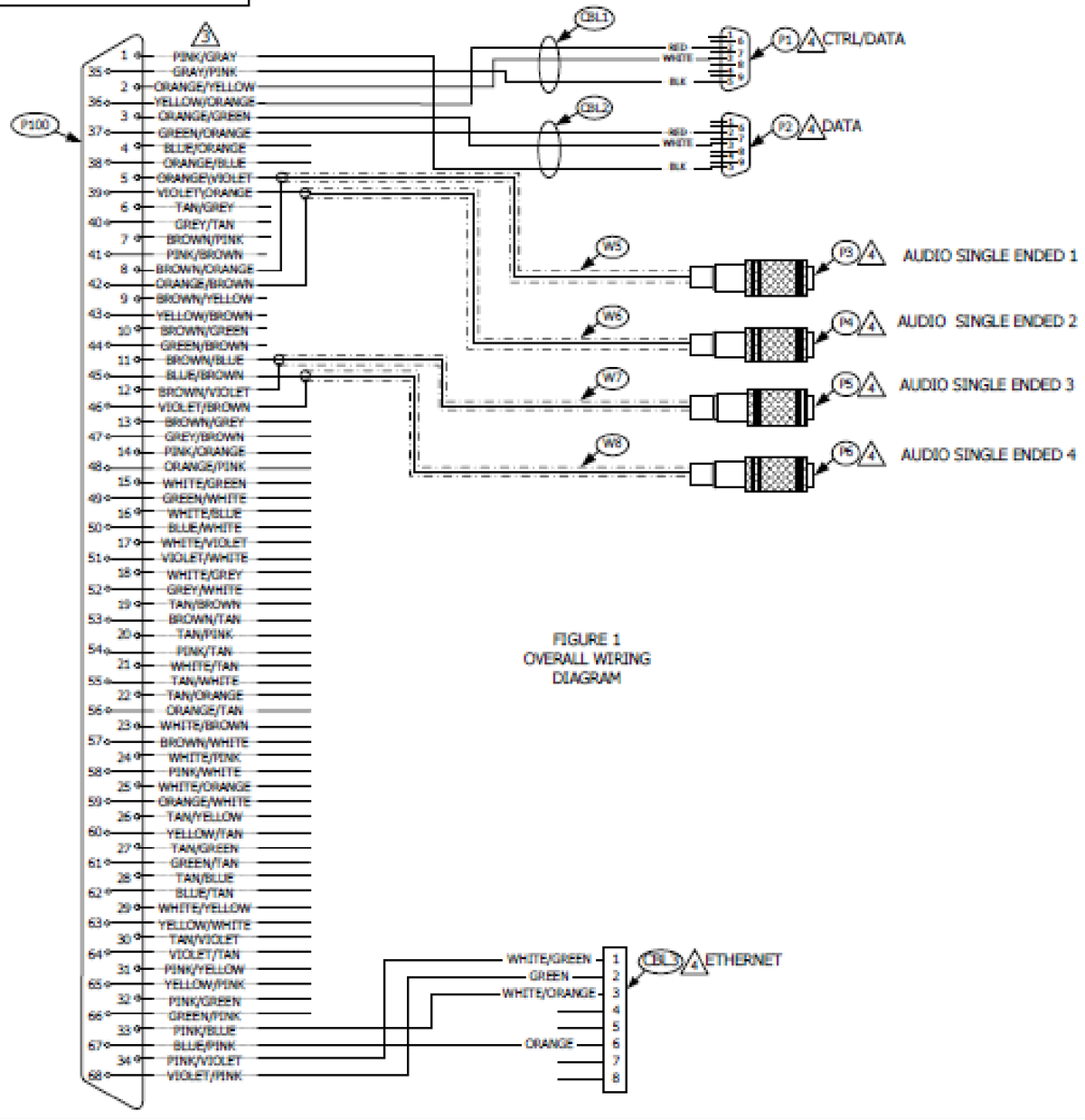


FIGURE 1
OVERALL WIRING
DIAGRAM

COBHAM
GMS INC. DBA COBHAM TACTICAL COMMUNICATIONS AND SURVEILLANCE
DWG TITLE: CABLE,M2TE,BREAKOUT,CTL/RCA
SIZE: B | DWG NO: 100-C0554X3 | REV: X3
SCALE: NONE | VISIO DWG | SHEET: 2 OF 5

Appendix C - Factory Default Set-up Groups

Dual Program Versions (2K Only)

Group Index	Group Name	Video bitrate allocate%	Video1 Input Mode	Video2 Input Mode	Stereo Stream 1 Input Mode	Analog Audio 1-2 Sample Rate	Stereo Stream 1 Encode Bitrate	Stereo Stream 2 Input Mode	Analog Audio 3-4 Sample Rate	Stereo Stream 2 Encode Bitrate	Aud 1 Volume (dB)	Aud 2 Volume (dB)	Audio 1-2 Pair Volume Lock	Audio 1 Mic PreAmp	Audio 2 Mic PreAmp	Audio 3 Volume (dB)	Audio 4 Volume (dB)	Audio 3-4 Pair Volume Lock	Audio 3 Mic PreAmp	Audio 4 Mic PreAmp	Video 1 Frame Reduction	Video 2 Frame Reduction	Transport Stream Source	Encryption	Aux Data	Streaming
1	1999.0 MHz,S:HD, RNG-M,QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
2	2245.0 MHz S:HD ,RNG-M, QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
3	2462.0 MHz, S:HD ,RNG-M, QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
4	1999.0 MHz, S:HD, RNG-M,QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
5	2245.0 MHz ,S:HD, RNG-M,QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
6	2462.0 MHz, S:HD,RNG-M, QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
7	1999.0 MHz, S:HD, RNG-M,QLTY-6	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
8	2245.0 MHz ,S:HD, RNG-M,QLTY-6	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
9	2462.0 MHz, S:SD ,RNG-H, QLTY-8	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
10	1999.0 MHz, S:SD, RNG-H,QLTY-9	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
11	2245.0 MHz D:HD, RNG-L, QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
12	2462.0 MHz, D:HD, RNG-L, QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
13	1999.0 MHz, D:HD, RNG-L,QLTY-5	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
14	2245.0 MHz ,D:HD, RNG-L,QLTY-5	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
15	2462.0 MHz D:HD,RNG-L, QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
16	1999.0 MHz, D:HD, RNG-L,QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
17	2245.0 MHz D:HD,RNG-L, QLTY-6	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
18	1999.0 MHz, D:HD, RNG-L,QLTY-6	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
19	2245.0 MHz D:SD,RNG-M, QLTY-5	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
20	2462.0 MHz, D:SD,RNG-M, QLTY-6	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF

Group Index	COFDM Mod Mode	COFDM BW	COFDM FEC	COFDM Guard Interval	RF Carrier MODE	L8 Band Carrier Freq (MHz)	L2 Band Carrier Freq (MHz)	S2 Band Carrier Freq (MHz)	S1 Band Carrier Freq (MHz)	F2 Band Carrier Freq (MHz)	S3 Band Carrier Freq (MHz)	CG Band Carrier Freq (MHz)	C2 Band Carrier Freq (MHz)	C9 Band Carrier Freq (MHz)	CA Band Carrier Freq (MHz)	F3 Band Carrier Freq (MHz)	F4 Band Carrier Freq (MHz)	X7 Band Carrier Freq (MHz)	X8 Band Carrier Freq (MHz)	RF Control	RF Spectrum Inversion	RF PWR LVL	Transport Stream ID	Network ID	PMT 1 PID	PMT 1 Prog Num	Video 1 PID	Video 1 PCR PID	PMT 2 PID	PMT 2 Prog Num	Video 2 PID	Video 2 PCR PID	Stereo Stream 1 PID	Stereo Stream 2 PID
1	QAM16	8MHz	2/3	1/32	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
2	QAM16	8MHz	2/3	1/16	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
3	QAM16	8MHz	2/3	1/32	2K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
4	QAM16	8MHz	2/3	1/16	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
5	QAM16	8MHz	2/3	1/32	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
6	QAM16	8MHz	2/3	1/16	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
7	QAM16	8MHz	2/3	1/8	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
8	QAM16	8MHz	2/3	1/8	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
9	QPSK	8MHz	2/3	1/16	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
10	QPSK	8MHz	2/3	1/14	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
11	QAM64	8MHz	3/4	1/32	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
12	QAM64	8MHz	3/4	1/32	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
13	QAM64	8MHz	3/4	1/16	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
14	QAM64	8MHz	3/4	1/16	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
15	QAM64	8MHz	3/4	1/32	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
16	QAM64	8MHz	3/4	1/32	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
17	QAM64	8MHz	2/3	1/32	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
18	QAM64	8MHz	2/3	1/16	2 K Carrier	1535	1850	1999	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
19	QAM16	8MHz	2/3	1/16	2 K Carrier	1435	1700	2245	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
20	QAM16	8MHz	1/2	1/4	2 K Carrier	1485	1775	2462	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61

Single Program Versions

Group Index	Group Name	Video bitrate allocate%	Video1 Input Mode	Video2 Input Mode	Stereo Stream 1 Input Mode	Analog Audio 1-2 Sample Rate	Stereo Stream 1 Encode Bitrate	Stereo Stream 2 Input Mode	Analog Audio 3-4 Sample Rate	Stereo Stream 2 Encode Bitrate	Aud 1 Volume (dB)	Aud 2 Volume (dB)	Audio 1-2 Pair Volume Lock	Audio 1 Mic PreAmp	Audio 2 Mic PreAmp	Audio 3 Volume (dB)	Audio 4 Volume (dB)	Audio 3-4 Pair Volume Lock	Audio 3 Mic PreAmp	Audio 4 Mic PreAmp	Video 1 Frame Reduction	Video 2 Frame Reduction	Transport Stream Source	Encryption	Aux Data	Streaming
1	1999.0MHz,S:HD, RNG-M,QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
2	2245.0 MHz S:HD ,RNG-M, QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
3	2462.0 MHz, S:HD ,RNG-M, QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
4	1999.0 MHz, S:HD, RNG-M,QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
5	2245.0 MHz ,S:HD, RNG-M,QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
6	2462.0 MHz, S:HD,RNG-M, QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
7	1999.0 MHz, S:HD, RNG-M,QLTY-6	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
8	2245.0 MHz ,S:HD, RNG-M,QLTY-6	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
9	2462.0 MHz, S:HD ,RNG-H, QLTY-8	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
10	1999.0 MHz, S:SD, RNG-H,QLTY-10	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
11	2245.0 MHz S:HD, RNG-M, QLTY-1	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
12	2462.0 MHz, S:HD, RNG-M, QLTY-1	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
13	1999.0 MHz, S:HD, RNG-M,QLTY-2	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
14	2245.0 MHz ,S:HD, RNG-M,QLTY-2	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
15	2462.0 MHz S:HD,RNG-M, QLTY-1	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
16	1999.0 MHz, S:HD, RNG-M,QLTY-1	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
17	2245.0 MHz S:HD,RNG-M, QLTY-3	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
18	1999.0 MHz, S:HD, RNG-M,QLTY-3	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
19	2245.0 MHz S:SD,RNG-H, QLTY-2	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
20	2462.0 MHz, S:SD,RNG-H, QLTY-3	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF

Group Index	COFDM Mod Mode	COFDM BW	COFDM FEC	COFDM Guard Interval	RF Carrier MODE	L8 Band Carrier Freq (MHz)	L2 Band Carrier Freq (MHz)	S2 Band Carrier Freq (MHz)	S1 Band Carrier Freq (MHz)	F2 Band Carrier Freq (MHz)	S3 Band Carrier Freq (MHz)	CG Band Carrier Freq (MHz)	C2 Band Carrier Freq (MHz)	C9 Band Carrier Freq (MHz)	CA Band Carrier Freq (MHz)	F3 Band Carrier Freq (MHz)	F4 Band Carrier Freq (MHz)	X7 Band Carrier Freq (MHz)	X8 Band Carrier Freq (MHz)	RF Control	RF Spectrum Inversion	RF PWR LVL	Transport Stream ID	Network ID	PMT 1 PID	PMT 1 Prog Num	Video 1 PID	Video 1 PCR PID	PMT 2 PID	PMT 2 Prog Num	Video 2 PID	Video 2 PCR PID	Stereo Stream 1 PID	Stereo Stream 2 PID
1	QAM16	8MHz	2/3	1/32	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
2	QAM16	8MHz	2/3	1/16	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
3	QAM16	8MHz	2/3	1/32	2K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
4	QAM16	8MHz	2/3	1/16	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
5	QAM16	8MHz	2/3	1/32	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
6	QAM16	8MHz	2/3	1/16	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
7	QAM16	8MHz	2/3	1/8	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
8	QAM16	8MHz	2/3	1/8	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
9	QPSK	8MHz	2/3	1/16	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
10	QPSK	8MHz	2/3	1/14	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
11	QAM16	8MHz	3/4	1/32	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
12	QAM16	8MHz	3/4	1/16	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
13	QAM16	8MHz	3/4	1/32	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
14	QAM16	8MHz	3/4	1/16	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
15	QAM16	8MHz	3/4	1/32	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
16	QAM16	8MHz	3/4	1/16	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
17	QAM16	8MHz	2/3	1/8	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
18	QAM16	8MHz	2/3	1/8	2 K Carrier	1535	1850	1999	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
19	QPSK	8MHz	2/3	1/16	2 K Carrier	1435	1700	2245	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
20	QPSK	8MHz	1/2	1/4	2 K Carrier	1485	1775	2462	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61

Dual Program Versions (4K Only)

Group Index	Group Name	Video bitrate allocate%	Video1 Input Mode	Video2 Input Mode	Stereo Stream 1 Input Mode	Analog Audio 1-2 Sample Rate	Stereo Stream 1 Encode Bitrate	Stereo Stream 2 Input Mode	Analog Audio 3-4 Sample Rate	Stereo Stream 2 Encode Bitrate	Aud 1 Volume (dB)	Aud 2 Volume (dB)	Audio 1-2 Pair Volume Lock	Audio 1 Mic PreAmp	Audio 2 Mic PreAmp	Audio 3 Volume (dB)	Audio 4 Volume (dB)	Audio 3-4 Pair Volume Lock	Audio 3 Mic PreAmp	Audio 4 Mic PreAmp	Video 1 Frame Reduction	Video 2 Frame Reduction	Transport Stream Source	Encryption	Aux Data	Streaming
1	1999.0MHz,S:HD, RNG-M,QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
2	2245.0 MHz S:HD ,RNG-M, QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
3	2462.0 MHz, S:HD ,RNG-M, QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
4	1999.0 MHz, S:HD, RNG-M,QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
5	2245.0 MHz ,S:HD, RNG-M,QLTY-4	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
6	2462.0 MHz, S:HD,RNG-M, QLTY-5	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
7	1999.0 MHz, S:HD, RNG-M,QLTY-6	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
8	2245.0 MHz ,S:HD, RNG-M,QLTY-6	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
9	2462.0 MHz, S:SD ,RNG-H, QLTY-8	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
10	1999.0 MHz, S:SD, RNG-H,QLTY-9	100	ON_AUTO	OFF	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	OFF	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
11	2245.0 MHz D:HD, RNG-M, QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
12	2462.0 MHz, D:HD, RNG-M, QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
13	1999.0 MHz, D:HD, RNG-M,QLTY-5	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
14	2245.0 MHz ,D:HD, RNG-M,QLTY-5	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
15	2462.0 MHz D:HD,RNG-M, QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
16	1999.0 MHz, D:HD, RNG-M,QLTY-4	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
17	2245.0 MHz D:HD,RNG-M, QLTY-6	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
18	1999.0 MHz, D:HD, RNG-M,QLTY-6	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
19	2245.0 MHz D:SD,RNG-H, QLTY-5	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF
20	2462.0 MHz, D:SD,RNG-H, QLTY-6	50	ON_AUTO	ON_AUTO	ANALOG SINGLE-ENDED LINE 1-2	48 KHZ	256 Kb/s	ANALOG SINGLE-ENDED LINE 3-4	48 KHZ	256 Kb/s	0	0	TRUE	+16 dB	+16 dB	0	0	TRUE	+16 dB	+16 dB	OFF	OFF	INTERNAL	OFF	OFF	OFF

Group Index	COFDM Mod Mode	COFDM BW	COFDM FEC	COFDM Guard Interval	RF Carrier MODE	L8 Band Carrier Freq (MHz)	L2 Band Carrier Freq (MHz)	S2 Band Carrier Freq (MHz)	S1 Band Carrier Freq (MHz)	F2 Band Carrier Freq (MHz)	S3 Band Carrier Freq (MHz)	CG Band Carrier Freq (MHz)	C2 Band Carrier Freq (MHz)	C9 Band Carrier Freq (MHz)	CA Band Carrier Freq (MHz)	F3 Band Carrier Freq (MHz)	F4 Band Carrier Freq (MHz)	X7 Band Carrier Freq (MHz)	X8 Band Carrier Freq (MHz)	RF Control	RF Spectrum Inversion	RF PWR LVL	Transport Stream ID	Network ID	PMT 1 PID	PMT 1 Prog Num	Video 1 PID	Video 1 PCR PID	PMT 2 PID	PMT 2 Prog Num	Video 2 PID	Video 2 PCR PID	Stereo Stream 1 PID	Stereo Stream 2 PID
1	QAM16	8MHz	2/3	1/32	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
2	QAM16	8MHz	2/3	1/16	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
3	QAM16	8MHz	2/3	1/32	2K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
4	QAM16	8MHz	2/3	1/16	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
5	QAM16	8MHz	2/3	1/32	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
6	QAM16	8MHz	2/3	1/16	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
7	QAM16	8MHz	2/3	1/8	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
8	QAM16	8MHz	2/3	1/8	2 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
9	QPSK	8MHz	2/3	1/16	2 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
10	QPSK	8MHz	2/3	1/14	2 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
11	QAM16	8MHz	2/3	1/32	4 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
12	QAM16	8MHz	2/3	1/16	4 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
13	QAM16	8MHz	2/3	1/32	4 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
14	QAM16	8MHz	2/3	1/16	4 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
15	QAM16	8MHz	2/3	1/32	4 K Carrier	1535	1850	2462	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
16	QAM16	8MHz	2/3	1/16	4 K Carrier	1435	1700	1999	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
17	QAM16	8MHz	2/3	1/8	4 K Carrier	1485	1775	2245	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
18	QAM16	8MHz	2/3	1/8	4 K Carrier	1535	1850	1999	2400	2462	2700	3400	5000	4990	5500	5825	5900	6525	7125	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
19	QPSK	8MHz	2/3	1/16	4 K Carrier	1435	1700	2245	2200	2412	2400	3100	4400	4940	5000	5725	5500	6425	6875	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61
20	QPSK	8MHz	1/2	1/4	4 K Carrier	1485	1775	2462	2300	2437	2550	3250	4700	4965	5250	5775	5700	6475	6950	RF ON	NORMAL	4	1	100	32	1	40	50	33	2	41	51	60	61